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ABSTRACT

The goal of the Developmental Approaches in Science, Health and Technology (DASH) program is to preserve the curiosity and capture the imagination of all elementary students through an experience of science, technology, and health that engages them in the excitement of exploring and understanding the unknown, inventing and building to solve problems, becoming better able to care for themselves, and gaining basic meaningful knowledge that will enable further school study. This document contains a teacher's guide for 3rd grade level. The document is divided into sections based on content. Activities include: (1) Learning; (2) Time, Weather and Sky; (3) Animals; (4) Plants; (5) Food and Nutrition; (6) Health and Safety; (7) Wayfinding and Transportation; (8) Energy and Communication, Conservation, Recycling, and Decomposition; (10) Matter, Space and Construction; (11) Start-up Activities; (12) Activity Plans; (13) Scope and Sequence; (14) Material List; and (15) Complimentary Materials. Each lesson plan includes objectives, background, student role, required materials, product, and procedure information. (Author/YDS)

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Grade 3 Teacher Guide

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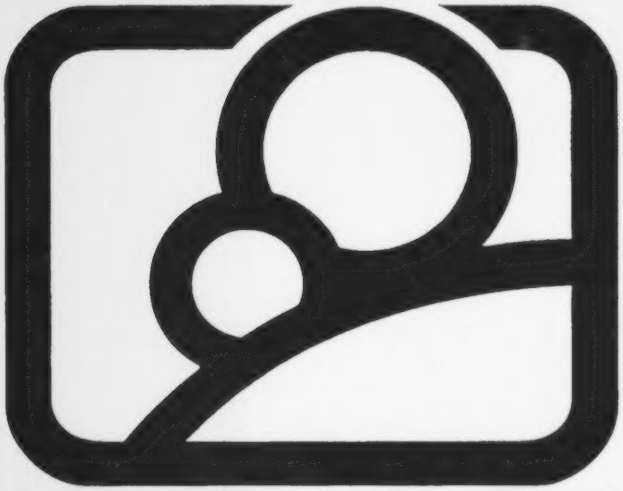

DASH

Developmental Approaches in Science, Health and Technology

SE067330

CRDG Curriculum Research & Development Group
University of Hawai‘i

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DEVELOPMENTAL APPROACHES IN SCIENCE, HEALTH AND TECHNOLOGY (*DASH*) PROGRAM
GRADE 3 TEACHER GUIDE

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DASH
PROGRAM LEARNING GOALS

The goals and objectives of DASH are included in the DASH Teacher Guides at each grade level. There are four tiers of goal statements in DASH. The overview, Tier 1, is the DASH program goal for students expressing the program's aspirations for students. At Tier 2 are fifteen program learning goals that categorize general kinds of learning DASH students at all grade levels should work toward to achieve the program goal for students. At Tier 3 are the DASH grade level activity learning goals that are specific for each activity and constitute subcategories of learning within the program learning goals. At the base, Tier 4, are the activity objectives that stipulate what the student should do to reach the activity learning goals. Listed here are the Tier 1 and Tier 2 program learning goals that embrace the entire program. Activity learning goals are found after each cluster's title page and the activity objectives are found within each activity of DASH grade level Teacher Guides.

The DASH program goal for students is to preserve the curiosity and capture the imagination of all elementary students through an experience of science, technology, and health that engages them in the excitement of exploring and understanding the unknown, inventing and building to solve problems, becoming better able to care for themselves, and gaining basic meaningful knowledge that will enable further school study.

The learning goals of DASH are to begin development of and increase students'

1. knowledge and understanding of the foundational concepts of natural sciences.
2. knowledge and understanding of the concepts fundamental to maintenance of human health.
3. knowledge and understanding of the operations of the technologies.
4. knowledge and understanding of the connectedness of the sciences, technologies, and the needs of society.
5. abilities to inquire about the unknown in the world about them using the tools of science.
6. abilities to invent, design, make, and test solutions to problems.
7. abilities to use the knowledge of science, health, and technology in new situations.
8. abilities to apply language, mathematics, and pictorial conventions as they are needed in science, health, and technology studies.

9. abilities to work cooperatively, collaboratively, and independently as appropriate in science, health, and technology contexts.
10. commitment to the well-being of the natural environment.
11. commitment to the well-being of self and community.
12. awareness of the importance of personal learning about science, health, and technology.
13. learning the ways of science, health, and technology for the excitement and pleasure they bring without concern for gender, ethnicity, or perceived ability.
14. readiness for the science experience of later studies.
15. appreciation for the contributions science, health, and technology make to society.

DASH

GRADE THREE
CLUSTER 1

LEARNING

3.1.1 The Learning Calendar
3.1.2 Last Year
3.1.3 Responsibility
3.1.4 Planning
3.1.5 Organizing Our Environment
3.1.6 Friends
3.1.7 Giving and Receiving
3.1.8 Working Together
3.1.9 Helping Myself and Others
3.1.10 Aphorisms
3.1.11 Next Year
3.1.12 Carey's Garden
3.1.13 Concept and Skill Inventory

3.1.1 THE LEARNING CALENDAR

OBJECTIVES

The students
- Record data needed in long-term studies in meteorology and astronomy.
- Record important environmental events.
- Record important class events.

BACKGROUND

The DASH Learning Calendar is used at each grade level. It is designed to be a class science, health, and technology log. The students record data for their long-term studies in meteorology and astronomy, things they have learned, important class events, and unusual occurrences in the natural environment.

DASH assumes that students learn through the experience of personally interpreting the world around them. Many phenomena can be interpreted effectively only after extensive long-term data collection. This is particularly true in the case of meteorological and astronomical phenomena. Data concerning the same phenomena are collected over several school years in DASH, and each year they are subject to a growing interpretation.

The nature of the DASH Learning Calendar changes as the students progress through different developmental levels. In kindergarten and grade one the calendar record is usually highly pictorial. This pictorial representation allows younger students to more easily record and retrieve information. In grade two or three, depending on the development of the particular class of students, a transition occurs as students move to a written recording mode.

The calendar is largely used to record the things learned about science during the day in kindergarten through grade two. As part of the mental health (self-esteem and interpersonal relationships) component of DASH, records are kept of things important to individuals and the class as a whole. To extend interest in the world of

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science, technology, and natural events, the students are encouraged to add current event items to the calendar.

The calendar is recorded on heavy, long-carriage computer paper. This paper produces a record that can be used and stored as a book and can be stretched out to make a continuous record. In the early grades some teachers prefer to use a 24-inch-wide roll of heavy butcher paper. At the end of each school year the calendar is stored in the library so that data can be used in later classes.

Data collection should begin on the first day of the school year. If the equipment needed for weather measurements is not available, groups of students can make it for the class. Students who were not in grade two DASH should be assigned to work with students who were to make the new equipment. See Activity 3.2.1 WEATHER.

By grade three the students have dealt with seasons sufficiently to be able to color-code the calendar. The edges of the pages can be given a summer, fall, winter, and spring color stripe so that seasonal segments of the calendar can be identified when seen from the side.

The responsibility for making entries on the calendar can be assigned to groups of two or more students. This solves the problem of people being absent on the day of their assignment. This group responsibility also involves more students regularly so that the class as a whole has a greater sense of contribution to their calendar.

Astronomical data can be obtained from observation, newspapers, phone calls to the local or national weather service, and almanacs. Students with previous experience in dealing with the astronomical data can begin to practice their predictive skills by checking them against published data.

The Learning Calendar is reviewed periodically. One successful schedule is to review at the end of the first week of school, at the end of the first month of school, and at the end of each school quarter. Open house provides a wonderful opportunity to have the students share the calendar with their parents.

In grade three the students continue to record the information introduced in previous years. High and low inside and outside Celsius and Fahrenheit temperatures, weather conditions represented by logos, the amount of rain and snow, and wind speed and direction are observed and recorded. Astronomical data including moon phase, the season, sunrise, sunset, moonrise, moonset, and the dates of solstices, equinoxes, and eclipses are also recorded. During the year, the students begin to record humidity data, more precise wind direction information, and their observations of the zodiacal constellations and planets.

The development of the DASH K–6 Learning Calendar is summarized on the following table.

DASH LEARNING CALENDAR

(K-6) Day, Date, Month, Year
(K-6) Special Events: Birthdays, Holidays, School Events

Temperature	Weather	Wind	Astronomy
(K) C F	Logos	Speed	Moon phase Season
(1) In/Out		Direction	Sunup/down
	Solstice/Equinox		
(2) High/Low	Rain/Snow	Beaufort	Moonrise/set Eclipse
(3)	Humidity	NE/SW	Polar Constellations
	Comfort Scale	NW/SE	Venus
(4)	Clouds Fronts Predictions	Wind chill	Constellations Planets Gnomon
(5)	Dew point Air Pressure		Tides Solar System
(6)	Global Climate		Mars Simulation

(K-6) What did I learn in school today?

NEWS:	(K-2)	Local catastrophes
	(3)	National catastrophes and health news
		Global and national weather events
	(4)	Local and national weather maps
		Science and technology articles
	(5)	Laws affecting science and technology
	(6)	Global science and technology

STUDENT ROLES

Astronomer
Meteorologist
Chronicler

MATERIALS

almanac, newspaper, tide calendar, or other source of astronomical data
markers
chart paper
calendar paper
Student Page 3.1.1 CALENDAR REVIEW

PRODUCTS

DASH Learning Calendar
Class responsibility chart
Completed Student Pages

PROCEDURES

1. **Introduce the calendar to the class by discussing the need to collect data each day for interpretation. Have the students list the information to be collected and set up a Class Responsibility Chart.**

   Help them to include
   - Day, month, year, and season.
   - Temperature data.
     ✔ Fahrenheit and Celsius, inside and outside, AM and PM.
   - Rainfall and snowfall.
   - Wind direction and speed.
   - Weather information.
   - Sunrise, sunset, moonrise, moonset, and moon phase.
   - Special events like birthdays, holidays, school events, local and national events, and health news.

2. **Have the students make the weather instruments needed to make their weather measurements.**

Have them make
- A chart of logos for weather conditions.
  ✔ See Activity 3.2.1

- A wind direction and speed indicator.
  ✔ See Activity 3.2.3

- Rain and snow gauges.
  ✔ See Activity 3.2.4

- A chart of logos for moon phases.
  ✔ See Activity 3.2.1

- A chart of logos based on the Beaufort windspeed scale.
  ✔ See Activity 3.2.3

3. **Have the class organize the calendar so there is an assigned place on the calendar panel for each item they are to record.**

4. **Periodically unfold the calendar and have the students review and discuss the data they have collected. Use Student Page 3.1.1 CALENDAR REVIEW.**

DASH

3.1.2 LAST YEAR

OBJECTIVES

The students
- Retrieve their Science Record Books from the library.
- Review what they did in the second grade.
- Review questions in their Wonder and Discover Book that have not yet been answered.

BACKGROUND

The continuity in conceptual development from grade to grade is an important component of DASH. To help ensure this continuity, several kinds of records are designed to be kept and passed from one grade to the next. These records include the Learning Calendar (kept in the library), the Working Dictionary (one copy for each next level teacher), the Wonder and Discover Book (one copy for each next level teacher), the Connections Book (one copy for each next level teacher), and the students' Science Rocord Books (kept for each student).

The Learning Calendar is kept in its box or as a roll. It is made available in the school library to classes in subsequent years when the students are studying seasonal and astronomical data. This will be especially important in grade four.

Ideally, the Working Dictionary is photocopied at the end of each school year. A copy of the Working Dictionary is passed on to each teacher at the next grade level who receives the DASH students that created the dictionary during the previous year. Each third grade teacher will probably receive several Working Dictionaries. This multiplicity will broaden the ideas to be rationalized as working definitions continue to evolve.

The Wonder and Discover Book and the Connections Book are also photocopied at the end of the year so that copies can be passed on to each next-grade teacher receiving students from a DASH class. The record in the Wonder and Discover Book of ideas yet to be investigated helps give the students a sense of direction as they start the new year.

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The collection of connections made in prior years gives them a strong starting base on which to build new knowledge.

An alternative to photocopying the Working Dictionary, the Connections Book, and the Wonder and Discover Book is to have the students make their own copies of the definitions, connections, and questions and store them in their Science Record Books.

The Science Record Book is the personal record of important information that needs to be passed from one year to the next for long-term studies. It normally includes personal growth charts, personal dental records, concept and skill inventories, and records of long-term projects such as decomposition investigations, astronomical observations, and seasonal change studies.

Ideally the Science Record Books, the Wonder and Discover Books, the Connections Book, and the Working Dictionaries are stored in the library over the summer and then checked out in the fall or as needed. The Science Record Books have a library code number put on them by the students the previous spring when they stored their books in the library. The students also made a card for the card file. See Activity 3.1.11 NEXT YEAR for an activity parallel to the one done in second grade. The retrieval of books is intended to give the students a sense of the importance of their personal work and to reinforce the idea that science is based on the long-term collection of information. To emphasize the importance of the work the retrieval is done with some ceremony. This is the time when the librarian discusses the importance of the library as a repository of works of knowledge.

After retrieval the students take time to review the documents.

STUDENT ROLES

Scientist
Chronicler

MATERIALS

Science Record Books
Wonder and Discover Books
Working Dictionaries
Connections Books
Student Page 3.1.2 QUESTIONS

PRODUCT

Completed Student Pages

PROCEDURES

1. **Discuss with the class the need to retrieve their Science Record Books, Wonder and Discover Books, Working Dictionaries, and Connections Books from last year.**

   Ask such questions as these:
   - Does anyone recall what we did with our books last year?
     ✔ Help the students recall that the books were stored in the library and that they used a special code to identify the books.

   - Does anyone have an idea of how we can find out what that code is?
     ✔ Help the students recall that they also made cards for the card file and they can use these to find the code.

   - Does anyone have an idea of how we can find our cards easily?
     ✔ Help the students remember that the cards were filed alphabetically.

2. **Work with the librarian to help the students locate and retrieve their books.**

   Ask the librarian to help the students to
   - Get the DASH cards out of the file to find their code.

   - Get access to the storage area where their Science Record Books are stored.

   - Go on a guided tour of the library's resources to see how they are accessed.

3. **Have the students review their questions from the previous year's Wonder and Discover Books.**

   Have them
   - Answer any questions left unanswered in the spring for which they have new information.

- Add new questions that they have after the summer.
  ✔ If these are questions of fact, suggest that anyone interested do some library research on the question.

- Record their personal questions on Student Page 3.1.2 QUESTIONS.

4. **Have the students review their Working Definitions, connections, and other collected data when the ideas are discussed in related third grade activities.**

5. **Have the students go through their Science Record Books.**

   Ask such questions as these:
   - What did we do last year?
   - What helps tell us what we did?
     ✔ Work to the idea that the Concept and Skill Inventory and the Student Pages help tell what they covered.
   - Looking at last year's Growth Chart information, how much do you think you have grown this year?

EXTENSIONS

- Have students report on the book retrieval codes used in the school and public libraries.

- Have them describe how they find the books that they want.

3.1.3 RESPONSIBILITY

OBJECTIVES

The students
- Plan for carrying out classroom jobs.
- Record the completion of their assigned responsibilities.

BACKGROUND

This activity follows Activity 3.1.1 THE LEARNING CALENDAR. Because there are many projects and responsibilities in a DASH classroom, it is important that a record be kept of who is to do what.

Set aside a short time on Monday morning or Friday afternoon for checking and updating the Responsibility Chart. Additional responsibilities can be added to the chart at any time. Some jobs may require more than one student to accomplish. Most jobs should be rotated regularly.

STUDENT ROLES

Planner
Recorder

MATERIALS

chart paper
markers
stickers (optional)
Student Page 3.1.3 HOME RESPONSIBILITIES

PRODUCTS

Posters of job requirements
Class Responsibility Chart
Completed Student Pages

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PROCEDURES

1. **Introduce the Class Responsibility Chart to the students.**

   Ask such questions as these:
   - Why do we need a class Responsibility Chart?
   - What jobs need to be done?
   - Why is it important to keep a record of who does which job?
   - Why should we report or check off that we have done our job?
   - What happens when we do not do the things that we have agreed to do?
   - What should we do if someone is absent?

2. **Have the students make a list of jobs that need to be done.**

   Have them
   - Discuss what kind of jobs need to be done to keep the classroom neat, clean, and running smoothly.
   - Make a list of data that need to be collected daily.
   - Add jobs when there are special projects that should be added to the list.

3. **Have the students put the list of jobs on the Class Responsibility Chart and discuss the procedures for its use.**

   Have them
   - Decide on a job selection and rotation process.
   - Volunteer or assign the jobs.
   - Make posters with the requirements of each job.
   - Hang the posters in the appropriate job areas.

4. **Review the Responsibility Chart with the class.**

   Have them
   - Review the list of jobs periodically.
   - Rotate the job assignments regularly.

- Suggest ways for improvement.

EXTENSION

- Have the students keep a Responsibility Chart for jobs they have at home using Student Page 3.1.3 HOME RESPONSIBILITIES.

3.1.4 PLANNING

OBJECTIVES

The students
- Keep a planning calendar.
- Use the planning calendar to initiate plans for special activities.

BACKGROUND

This activity is an ongoing part of the DASH time theme. It is designed to aid students in anticipating and planning for holidays, vacations, birthdays, major school events, and classroom projects. The Planning Calendar is used to remind the class of upcoming events. It identifies the day events occur. These events are recorded on the Learning Calendar as they occur.

The Planning Calendar is a standard commercial calendar on which all important upcoming events are written. This calendar shows the whole year on one large sheet. It specifies a weekly planning time when future events are discussed. This is also the time when the Responsibility Chart from Activity 3.1.3 RESPONSIBILITY is updated. Planning is probably best done on the first or last day of the week.

If a year calendar on a single sheet of heavy paper cannot be easily obtained from a stationery store, one can be made on a large sheet of oaktag.

STUDENT ROLE

Planner

MATERIALS

calendar for a year on one large sheet of heavy paper
markers
Student Page 3.1.4 MONTHLY PLANNING CALENDAR

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PRODUCTS

The Planning Calendar
Completed Student Pages

PROCEDURES

1. **Introduce the Planning Calendar to the students by discussing the need to know about and plan for future events. Have them decide how to record information.**

2. **Have the students plan for the coming month using Student Page 3.1.4 MONTHLY PLANNING CALENDAR.**

   - As things are recorded on the Planning Calendar, have the students record them on their Monthly Planning Calendars.

   - Once the students are familiar with the planning and recording procedures, information can just be recorded on the Planning Calendar.

3. **Have the class plan for upcoming events and projects. Have them update their Planning Calendar and Student Page 3.1.4 MONTHLY PLANNING CALENDAR once each week at planning time or as appropriate.**

   Ask questions such as these:
   - What holidays are coming?
   - What birthdays are coming?
   - What special school events are coming?
   - Are there special school events we should plan for?
   - Are there vacations we should plan for?
   - Are there other things we should be planning for?

4. **Have the students form a planning committee to remind the class when some action is to be taken.**

EXTENSIONS

- Have the students invent logos to represent various upcoming events.
- Have the students ask their parents how they make plans.
- Have the students ask their parents how planning is done where they work.

3.1.5 ORGANIZING OUR ENVIRONMENT

OBJECTIVES

The students
- Create a concept map of the term, "organize."
- Identify things that need to be organized in the classroom.
- Develop and carry out a plan of organization.

BACKGROUND

The theme of organization begins in kindergarten and continues through grade six. It is designed to fill a need for safety and ease of operations in the school environment. One of the great innovations of modern technology has been the organization of the workplace and the things within it. Education is a combination of art and technology. The smooth operation of the classroom is greatly facilitated by organization.

In this activity the students identify the kinds of things that can be organized to help the flow of ideas, people, and materials in the classroom. These should include such things as the organization of their notebooks, the contents of their desk, the storage of materials, and the reinforcement of regular and orderly performance of responsibilities.

STUDENT ROLES

Industrial designer
Planner

MATERIALS

chart paper
markers
Student Page 3.1.5 ORGANIZING

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PRODUCTS

Concept map on term organize
Completed Student Pages

PROCEDURES

1. **Have the students create a concept map of the term organize.**

   Help them include examples of
   - Planning.
   - Putting things in order.
   - Putting things away.
   - Storing things.
   - Deciding on the procedures for doing things.
   - Making things easier.
   - Making work safer.

2. **Have the class discuss things that have already been organized this year and things that still need to be organized.**

   Help the students include such things as
   - Jobs on the Responsibility Chart.
   - Information on the Learning Calendar.
   - Work in their notebooks.
   - Things in their desks.
   - Materials stored in the classroom.
   - Distribution of materials to the class.

   Have the students refer to their concept map on the term organize to explain why such organization is useful.

3. **Have groups of students plan an organizational structure or procedure for each of the items identified as needing organization in Procedure 2.**

   Have the students
   - Use Student Page 3.1.5 ORGANIZING to record their plans.
   - Report to the class on their organizational plans.
   - Agree upon a class plan for each item.

4. **Periodically have the students check to see that their organizational plans are being carried out.**

EXTENSIONS

- Have the students ask their parents and others how their workplaces are organized.
- Have the students report on how they organize their own things at home.

3.1.6 FRIENDS

OBJECTIVES

The students
- Make a concept map about friends, right things to do, and wrong things to do.
- Make connections between the three concept maps.
- Use their ideas to role-play several problem-solving scenarios.

BACKGROUND

Maintaining a friendship is one of the most important mental health skills that students need to develop. Keeping a friendship when problems arise is always difficult. One way to help students deal with these situations is to role-play scenarios of problems students typically face.

In this activity a group of student actors complete each scenario. Then the class acts as a group conscience to evaluate the actors' solution to the problem.

STUDENT ROLES

Actor
Problem-solver

MATERIALS

chart paper
markers
Student Pages 3.1.6A-C FRIENDS

PRODUCTS

Concept maps: friends, right things to do, wrong things to do
Completed Student Pages

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PROCEDURES

1. **Have the students work in groups or as a class to develop a concept map about friends.**

   Help the students to include such ideas as
   - Attitudes.
   - Feelings.
     ✔ Liking each other.
   - Doing things together.
   - Liking the same things.
   - Actions.
     ✔ They listen to each other, share things, forgive each other, are loyal, etc.
   - Responsibilities.
     ✔ They look out for each other, help each other, think about what is good for both themselves and their friend, etc.

2. **Have the students develop a second concept map about the right things to do.**

   Help them to include ideas under subconcepts such as
   - Laws.
     ✔ School, home, and government.
   - The Golden Rule.
   - Thinking first.
   - Aphorisms.
   - Avoiding Danger.

3. **Have the students make a third concept map about wrong things to do.**

   Help them to include ideas under subconcepts such as
   - Disobeying laws.
     ✔ Society, home, and school.
   - The Golden Rule.

- Acting before thinking.
- Aphorisms.
- Intentionally doing dangerous things.
- Intentionally hurting themselves and others.

4. **Have the class put the three concept maps together and show the connections between friendship and doing things that are right and wrong.**

   Ask such questions as these:
   - Do we always do the right thing?
   - How do friends help each other to keep from doing things that are not right?
   - How do friends deal with mistakes once they are made?

5. **Introduce the Group Conscience Game to the class.**

   Play the game as follows:
   - Read the problem-posing scenario.
   - Two students play the roles of friends and complete the scenario.
   - The audience plays the role of a collective conscience. They discuss what was done and how the role-play relates to the characteristics of friendship and the right things to do.

6. **Have the students play the Group Conscience Game.**

   Have them use the following scenarios:
   - Scenario I
     Gail and Milly have been friends since first grade. They live near each other and go to and from school together every day. They spend a lot of time at each other's houses. Gail's mother says Milly is her other daughter, and Milly's mother calls Gail "Chicky" because she "roosts" so often with Milly. Today before she met Gail to go to school, Milly found a wallet by the side of the road. There were credit cards, a driver's license, a picture of three children, and $78 in it. Milly did not tell Gail what she had found. At lunch she said, "I have a surprise. Right after school we're going to stop at the Mall and each of us will buy ourselves a big present."

Have the actors complete the scenario in five minutes.
Have the audience discuss the scenario.

- Scenario II
  Rupert Adamson and Juan Delacruze are video game addicts. They have been sharing games with each other for over a year and a half. When they are not staring at their TV screen moving the hero through a field of traps and daggers they are talking together about their progress. Two weeks ago Rupe said to Juan, "We're getting too good at these games. My cousin Sheri showed me a new adventure game that she has. It is really complicated and fun. She lent it to me while she is away for the summer. The only problem is we need a computer to play it. Doesn't your dad have a computer we could use?" "Yah, but he said none of us kids can use it," answered Juan. "But your family doesn't get home until six, and he'll never know," said Rupe. Yesterday during the sixth attack on Castle Dower, Rupe dropped his fudge stick on the keyboard. Despite all their efforts to clean up the mess, the F, G, and T keys are not working. Juan invited Rupe to stay for supper. Mrs. Delacruze has just sat down to the computer to do the income taxes.

- Scenario III
  Fran spends summers with Kelly on her grandmother's farm. Kelly lives with Grandma and helps with things on the small farm when she's not in school. In the summer during her visit Fran helps Kelly collect the eggs, slop the pig and her piglets, and keep the house clean. When they are not working, Fran and Kelly go fishing, watch TV, and sometimes play Rattle with the kids down the road.

  Rattle is a game in which everyone except the rattler hides in the barn. The rattler tries to find and catch someone as in hide-and-seek. When someone is found, the rattler shakes a rattle (they use a cow bell). When the kids hear the bell, everyone jumps up and tries to chase away the rattler by throwing wadded-up old grain sacks at him. If anyone hits the rattler, the rattler must leave and the game starts again with everyone hiding. If everyone misses, the rattler tries to catch someone before he or she reaches the barn door and that person becomes the new rattler. It is quite dark in the barn, so it's hard to hit the rattler.

  This afternoon Fran was feeling very sad because no birthday letter had come from home. Fran was mean to Kelly and called Jess Brown a dummy. Jess let fly a punch that knocked Fran down. It took all the kids to hold the two apart. Kelly got them to say they were sorry.

Later, when Jess was the rattler he was hit by a wad that was full of fine chicken mash. It made him look like a snowman. Jess thought Fran threw the wad so he chased her out of the barn, through the yard, and right into the arms of Mrs. Brown. "What is going on here?" demanded Mrs. Brown in her booming voice.

- Scenario IV
  Billy and Jerry met last year while playing ball at the gym. This year they are in the same class. They talk together a lot after school.

  Billy's older brother Phil, who is in the ninth grade, joined the Skulls. Some days the Skulls charge kids 50 cents to "protect them" on their way to and from school. Some Skulls stop Billy and Jerry one morning and demand "their" 50 cents.

  Jerry begins to cry and says, "You can't have it, that's my lunch money." Billy says, "You can't have mine either."

  "Get out of here kid," a Skull shouts at Billy. "You're Phil's kid brother." Then he turns on Jerry.

EXTENSION

- Have student groups invent their own scenarios for the game.

3.1.7 GIVING AND RECEIVING

OBJECTIVES

The students
- Make a concept map about giving and receiving.
- Discuss stories about the positive and negative aspects of giving and receiving.
- List the kinds of things that can be given and received.
- Discuss the importance of giving and receiving in the school and the community.
- Develop working definitions for giving and receiving.

BACKGROUND

A part of the mental health component in DASH deals with giving and receiving. Giving and receiving are fundamental interpersonal acts necessary to building social skills and positive self-esteem. Certain forms of giving and receiving are so important that they are stylized into a wide array of cultural customs. There are things we give, institutions and groups we give to, and particular ways of giving and responding. Without giving and sharing the world's goods would quickly be controlled by the fortunate and a society of oppression would result.

Students need to understand that giving and receiving are not limited to tangible things. Acts of helping and doing things for others that they cannot do or have a difficult time doing are also involved. Expressions of joy, confidence, support, faith, and love and acts of sacrifice, even the giving of life for others are also included. Biologists and psychologists call all of these acts of giving **altruism**. This tendency to give seems to be written into our basic genetic code. However, without careful nurturing this altruistic tendency can be smothered by obstructing habits of self-interest.

The classroom is a microsociety in which giving can be modeled, practiced, and supported in its growth. Because of the vulnerability of altruism it must be nurtured at both the cultural-mechanical level and the instinctive-spontaneous level if it is to become a natural part of the student. Cultural niceties must be consistently encouraged. Doors

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should be opened for the burdened, cheerful greetings and recognition given on meeting, a "thank you" and "you're welcome" said for gifts or courtesies received. The selfless instinct for giving and sharing must be cultivated to become an integral part of the natural response to a need.

The activity begins by reading a story which involves harmonious giving and receiving. This is a theme in which the giver has a good intent and the receiver shows gratitude. The story is followed by an exploration of cultural niceties that can be described, prescribed, and practiced. Students list the ways that they should give and receive gifts within the classroom and community and then practice those ways of giving and receiving.

Students next read several stories about problems in giving and receiving. These themes include selfishness and unmet need, giving and the rejection of the gift, and gifts that are dangerous to receive. The students discuss these problems and ways to cope with similar situations.

Finally, the students are asked to become observers and reporters of altruistic acts and non-altruistic acts.

STUDENT ROLES

Sociologist
Psychologist
Philosopher

MATERIALS

chart paper
markers
Working Dictionary
Learning Calendar
trade books:
harmonious giving and receiving
1986 Munch, Robert.
Love You Forever. Firefly Books: Willowdale, Ontario, Canada.
1985 Bang, Molly.
The Paper Crane. Mulberry Books: New York.
1985 McLerran, Alice.
The Mountain that Loved a Bird. Picture Book Studio: Saxonville, Massachusettes.

selfishness
1964 Silverstein, Shel.
The Giving Tree. Harper: New York.
1961 Seuss, Dr.
The Sneetches. Random House: New York.
gift rejection
1986 Carle, Eric.
The Grouchy Ladybug. Harper Trophy: New York.
dangerous gifts
fairy tales
The Golden Touch
Snow White
Student Pages 3.1.7A KINDS OF GIVING AND RECEIVING
3.1.7B FEELINGS ABOUT GIVING AND RECEIVING
3.1.7C PERSONAL GIVING AND RECEIVING

PRODUCTS

Concept map on giving and receiving
Working definitions for giving and receiving
Completed Student Pages

PROCEDURES

1. **Have the class make a cmap about giving and receiving.**

2. **Read and discuss with the students a story having a theme about harmonious or ideal giving and receiving.**

Ask such questions as these:

- Who was the giver?
- What was given?
- Did the giver receive anything in return for the gift? What?
- Who was the receiver?
- What did they receive? Why?
- How did they respond to the giving?
- What did they do with the gift?

3. **Have the students make a list of the kinds of things that people give one another, why they give such gifts, and to whom or what (pets, institutions) they make such gifts? Use SP 3.1.7A KINDS OF GIVING AND RECEIVING. Make additions to the concept map about giving and receiving.**

   Have them discuss their lists by asking such questions as
   - What do we mean by a tangible thing?
   - Which gifts involve tangible things? Why do we give this kind of gift? To whom or what do we give them?
   - What do we mean by knowledge?
   - Which gifts involve giving knowledge? Why do we give these kinds of gifts? To whom or to what might we give them?
   - What do we mean by emotions?
   - Which gifts involve emotions? Why do we give these kinds of gifts? To whom or to what might we give them?
   - What do we mean by sacrifice?
   - Which gifts involve sacrifice? Why do we give these kinds of gifts? To whom or to what might we give them?
   - What do we mean by kindness?
   - Which gifts involve kindness? Why do we give these kinds of gifts? To whom or to what do we give them?

4. **Have the students make a list of positive and negative feelings they have when they are givers and when they are receivers. Use SP 3.1.7B FEELINGS ABOUT GIVING AND RECEIVING. Make additions to the concept map about giving and receiving during the discussion.**

   Have them discuss their lists by asking such questions as
   - What positive feelings do you have about giving? Why?
     ✔ Work toward such ideas as the pleasure in doing for others, enjoyment in making others happy, etc.
   - What negative feelings do you have about giving? Why?
     ✔ Work toward such ideas as I feel I have to, it takes time, people don't say thanks, etc.

- What positive feelings do you have about receiving? Why?
  ✔ Work toward such ideas as it is wonderful to have someone help when I can't do something, it is a pleasure to get surprises, etc.

- What negative feelings do you have about receiving? Why?
  ✔ Work toward such ideas as I feel obligated to give back and can't, it makes me feel inferior, I have a hard time saying thanks, etc.

- Is giving necessary?
  ✔ Work toward agreement that giving of ourselves is essential. In the school community we share knowledge, we give warning and prevent accidents, we give cheerfulness, comfort, and friendship, we share equipment, etc. Help the students extend the idea to the larger community where such giving is essential to ease hardships.

5. **Have the students discuss how they can make giving and receiving positive events in their lives. Use SP 3.1.7C PERSONAL GIVING AND RECEIVING after the discussion.**

Help them to develop such ideas as
- Established habits of courtesy.
  ✔ Saying thank you, you are welcome, please, etc.

- Looking for situations where one can be helpful and then helping.

- Projecting a cheerful attitude.

- Making sharing and giving a habit.

6. **Read and discuss with the students a story about selfishness and an unmet need.**

Ask such questions as these:
- Who was selfish?

- Why were they selfish?

- Who was in need?

- Why were they in need?

- Why was there a change in attitude?

- Do you know people like those in the story?
- What would it take to change their attitude?
- Why is selfishness a poor way to respond to people around us?

7. **Read and discuss with the class a story about the rejection of a gift.**

   Ask such questions as these:
   - Who was given or offered the gift?
   - Why did they reject it?
   - Who was in need?
   - Why were they in need?
   - Why was there a change in attitude?
   - Do you know people like those in the story?
   - What would it take to change their attitude?
   - Why is rejecting gifts given freely a poor way to respond to the people around us?

8. **Read and discuss with the students a story about a gift that was dangerous to receive.**

   Ask such questions as these:
   - Who was given the gift?
   - What was the danger in receiving the gift?
   - Why was the gift rejected?
   - Do you know people like those in the story?
   - Why must gifts given by strangers be questioned?
   - How is the gift giving here different from other gift giving we have read about and discussed.

9. **Have the students observe and report on altruistic acts and non-altruistic acts. Have them record these acts on the Learning Calendar.**

10. **Have the students put additional ideas on their concept map about giving and receiving and then use their map to develop Working definitions for giving and receiving. Record their definitions in the Working Dictionary.**

EXTENSIONS

- Having the students make up aphorisms about giving and receiving.
- Have the students make up Thanksgiving or Christmas stories about giving and receiving.

3.1.8 WORKING TOGETHER

OBJECTIVES

The students
- Discuss the reasons for working cooperatively.
- Discuss the reasons for working individually.
- Establish a basis for deciding whether a project is best completed using a cooperative or an individual effort.

BACKGROUND

This activity should be introduced at the beginning of the year when the students are starting to take over the organization of their science activities. The discussion encourages them to reflect on why some work is better done individually and some cooperatively.

STUDENT ROLES

Project manager
Individual worker

MATERIALS

markers
chart paper
Science Record Books
Student Pages 3.1.8A WORKING TOGETHER: REASONS
3.1.8B WORKING TOGETHER: DECISIONS

PRODUCT

Completed Student Pages

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PROCEDURES

1. **Introduce the activity by discussing the reasons the class sometimes needs to work in groups when doing science, health, and technology projects. Have the students make a list of their reasons.**

   Help them include ideas such as
   - The need for many hands.
   - The need for different skills.
   - The need for sharing knowledge and experience.
   - The need for sharing ideas.
   - The need for sharing resources.
   - The need for mutual support.
   - The fun of working together.
   - The enjoyment of sharing in a common product.
   - The preference of some students to work with a group.
   - The best way in some circumstances for learning.

2. **Have the students make a list of reasons they sometimes need to work individually when they do science, health, and technology.**

   Help them include ideas such as
   - The project needs only one person to complete it.
   - Only one person is available to do the project.
   - All students have the skills necessary to complete the project.
   - All students have the ideas necessary to complete the project.
   - There are sufficient resources for each student to do the project.
   - Students want to do the project on their own.

- The fun of working alone.
- The enjoyment of doing something completely by oneself.
- The preference of some students to work alone.
- The best way in some circumstances for learning.

3. **Have the students discuss the kinds of activities that require group work and those that need individual work.**

   Help them to consider such things as
   - Projects that require more than one person need to be done by more than one person.
   - Projects that can be done by one person can often be divided up and done more efficiently by groups of people.
   - The decision to work individually or in groups can be a matter of teacher or group preference or convenience.

4. **Have the students compare their reasons by discussing what makes the two lists different.**

   Help the students
   - To understand that some reasons are based on needs and some on preference.

5. **Have the students record their final lists on Student Page 3.1.8A WORKING TOGETHER: REASONS and put their lists in their Science Record Books.**

6. **At the next appropriate opportunity, have the class apply their list of ideas to decide whether the activity should be done in groups or individually.**

EXTENSION

- Have the students use Student Page 3.1.8B WORKING TOGETHER: DECISIONS to decide whether other activities should be done in groups or individually. Have them work individually or in small groups and then compare and discuss their decisions with the rest of the class.

3.1.9 HELPING MYSELF AND OTHERS

OBJECTIVES

The students
- Identify how they have progressed in their ability to be self-sufficient.
- Identify how they have progressed in their ability to help others.
- Identify new goals for helping themselves and others.

BACKGROUND

This activity continues the theme of self-sufficiency and community contribution started in kindergarten. It should be introduced early in the school year. The purpose is to give students an opportunity to determine and monitor achievement of their personal goals. Ideally the students have a list of the personal goals they set at the end of second grade for the summer. These goals are evaluated and additional goals are added for grade three. The goals are re-evaluated between semesters or as a New Year activity and at the end of the school year. This activity can be done along with Activity 3.1.10 APHORISMS.

There are two parts to the personal goal setting activity. The first is things that I want to do for myself this year. The second part is things I want to do for others this year. The number of items listed by different students may vary widely. The number is not a concern. It is more important that the students set goals they can reasonably achieve. Further goals can be added each time they evaluate their achievement.

The students rate their achievement in two ways. They rate their ability to do the thing called for and the frequency of actually doing the thing when there is an opportunity to do it.

STUDENT ROLES

Self sufficient person
Community contributor

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MATERIALS

chart paper
markers
Student Page 3.1.9 HELPING MYSELF AND OTHERS

PRODUCTS

Class chart of possible goals
Completed Student Pages

PROCEDURES

1. **Have the students review their lists of personal goals they set at the end of grade two. Have them evaluate to see how well they have met their goals.**

2. **Discuss with the class the ideas of self-sufficiency and community contribution.**

   Ask such questions as these:
   - Why do we want to do things for ourselves?
   - What disadvantages are there in having to rely on others to help us do things?
   - How do you feel when you learn to do something that you have not been able to do for yourself before?
   - What are some of the things that even adults need help with?
     ✔ Get at such things as health, family, and job decisions.
   - Why do we want to be able to help others?

3. **Have the students discuss some of the things they might try to learn to do by themselves during the coming year. List these ideas on a Class chart of possible goals.**

4. **Have the students set their goals for achieving greater self-sufficiency during the coming year. This includes things from previous years that have not yet been achieved or mastered. Use Student Page 3.1.9 HELPING MYSELF AND OTHERS.**

5. **At the end of each semester have the students evaluate and reset their goals.**

Ask such questions as these:
- What help do you need to achieve your present goals?
- What additional goals have you set?

3.1.10 APHORISMS

OBJECTIVES

The students
- Discuss their understanding of some aphorisms.
- Rate themselves on how well they accomplish the goals set forth in the aphorisms.

BACKGROUND

Throughout DASH, the students get broad exposure to many recommended health practices. Various mnemonic reminding tools are used to help students remember and to draw their attention to these practices.

One of the devices that DASH uses is the aphorism, a short statement that expresses an important idea. Aphorisms often become so associated with daily activities that they are called to mind spontaneously at appropriate moments. DASH uses aphorisms, songs, and rhymes to help carry messages about appropriate health practices.

This activity is used at the end of each semester. The students rate each aphorism as to how well they understand it and how it affects their behavior.

STUDENT ROLE

Health consultant

MATERIALS

pencil
Student Page 3.1.10 APHORISMS

PRODUCT

Completed Student Pages

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PROCEDURES

1. **Have the students rate their understanding and practice of the aphorisms using Student Page 3.1.10 APHORISMS.**

2. **Discuss the meanings and values of the aphorisms.**

EXTENSIONS

- Have the students make up more aphorisms.
- Have the students make posters to illustrate their aphorisms.

APHORISMS

	CONCEPT	SUGGESTED APHORISM
1.	Eat adequate and appropriate food.	Eat right, feel right, grow right.
2.	Go slow on sugar, fat, and salt.	Slow down sugar, Slow down fat, A dash of salt Is enough of that.
3.	Get eight hours of sleep.	Sleep for eight, Wake up feeling great.
4.	Replace the water that you lose each day. Drink adequate amounts of liquids (6–8 glasses of water).	Six glasses in winter and eight in summer Are my body's natural plumber.
5.	Wash hands before eating. Wash hands before handling food. Wash hands after using the toilet.	Wash hands before eating or fixing a hurt, After using the toilet or working in dirt.
6.	Keep lips in the water and off the fountain.	Someone else's dishes are someone else's germs. Mouth in the water, Not in the fountain, Keeps those germs from growin' and sproutin'.
7.	Attend to tooth care. Brush twenty up and twenty down.	Brush twenty times up And twenty times down, Inside, outside, all around. Floss in between To complete the routine.
8.	Attend to skin and hair care.	Healthy skin and hair Are clean skin and hair.

9. Wear appropriate clothes for the weather and time of day.	Winter clothes feel comfortably warm. Summer clothes feel comfortably cool. Wear white at night.
10. Make regular use of the toilet.	When nature calls, Listen and go. Wipe and wash, And flush, just so.
11. Make your environment safe and clean.	A clean and safe space, Is a great workplace.
12. When sick stay away from others.	When you're sick, stay at home. Don't let your germs roam.
13. Seek help for wounds.	Every wound requires inspection. Untreated wounds invite infection.
14. Cover your nose and mouth when sneezing or coughing.	Don't sneeze or cough with the cover off.
15. Share with those about you.	Sharing with others is caring for others.
16. Remember your responsibilities and carry them out.	Get the job done, Then have fun.
17. Plan when you can.	Plan ahead.
18. Help those who need help.	Lend a hand, when you can.
19. Know the emergency phone number.	Remember 911 When emergencies come.
20. Play a fair game.	Play fair with others, and they'll play fair with you.
21. Put things away when you're finished.	Finished for today? Then put your things away.

22. Treat all living things with respect.	Respect all living things.
23. Exercise 20 to 30 minutes per day.	Exercise 20 minutes for heart insurance. Thirty minutes for heart endurance.
24. Stay away from recreational drugs, alcohol, and tobacco.	A smoker's a choker. There's no excuse for drug abuse. Alcohol makes your system stall.
25. If you really know and understand something, you can teach it.	If you really know and understand, Teach and give someone a hand.

3.1.11 NEXT YEAR

OBJECTIVES

The students
- Store their Science Record Books in the library for the summer.
- Make an identification card for the library file.
- Identify their books with a retrieval code.
- Store the DASH class books in the library for use in following years.

BACKGROUND

In DASH continuity of conceptual development from grade to grade is essential. Certain components are designed to be kept and transmitted from one grade to next. These records include the Learning Calendar, the Working Dictionary, the Connections Book, the Wonder and Discover Book, and the students' Science Record Books. If the books are stored in the school library, be sure to coordinate with the librarian ahead of time.

The Learning Calendar is kept in its box or roll in the library for use in following years.

The Working Dictionary is copied at the end of each school year. A copy is passed on to each fourth grade teacher receiving DASH students. Have the students put the definitions into a computer file and then photocopy the printout to facilitate this process. As an alternative the students can copy the definitions and store them in a section of their Science Record Books. Another alternative is to store the original class books in the library so that all classes have access to them. The Wonder and Discover Book and the Connections Book are copied and passed on to the fourth grade teachers in the same way.

Some information in each student's Science Record Book is kept from year to year. This includes personal growth and dental charts, Concept and Skill Inventories, records of personal goals, and information on long-term projects such as decomposition, astronomical observations, and seasonal change. Other data are included as deemed necessary by the teacher or students.

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The Science Record Books are stored in the library for the summer. They are checked out in the fall. The students make identification cards for their books for the library card file. They label their Science Record Books with the retrieval code used by the school library.

STUDENT ROLE

Librarian

MATERIALS

Science Record Books
Wonder and Discover Book
Working Dictionary
Connections Book
library coding materials
Student Page 3.1.11 LIBRARY CARD or cards provided by the school librarian

PRODUCT

Completed Student Pages

PROCEDURES

1. **Discuss with the students the need to store their Science Record Books, the Wonder and Discover Book, the Connections Book, and the Working Dictionary for next fall.**

   Help them include the need to
   - Code the books with the system the school library uses to identify books.
   - Make a card for the library card file so that the books can be found at a later date.
   - Make copies of the class books if necessary.

2. **Help the students code their books and make out the library cards. Use SP 3.1.11 LIBRARY CARD.**

3. **Have the students take their books and cards to the school librarian.**

EXTENSIONS

- Have the students organize the classroom library.
- Have them code the books and make a classroom library card file and cards for each book.
- Have them practice retrieving the books using the card file they have made.

3.1.12 CAREY'S GARDEN

OBJECTIVES

The students
- Read a story about the nature of science and technology.
- Create working definitions of science and technology.

BACKGROUND

This activity is designed to encourage students to begin to think about the nature of science and technology. This is a part of learning to learn in that it deals with how social observers, particularly philosophers, have divided the work of the technologists, the makers and doers, from the work of the scientists, the describers and explainers. Because this is a recurring theme in DASH, complete definitions are not necessary at this time.

Carey's Garden is full of humor, some of which may not be recognized by students. Humor takes social cultivation. Do not be concerned over the unrecognized aside or whimsical drawing. Recognition will come in time.

STUDENT ROLE

Philosopher

MATERIALS

chart paper
markers
Working Dictionary
Student Page 3.1.12 SCIENTIST OR TECHNOLOGIST?

PRODUCTS

Working definitions of science and technology
Science and Technology Book
Completed Student Pages

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PROCEDURES

1. **Have the students make a concept map of the terms science and technology. Have them organize the map into things that are common to both and things that are different.**

   Help them include such things as
   - Problem solving
     ✔ both science and technology
   - Invention
     ✔ both science and technology
   - Hypothesis or tentative guess
     ✔ science
   - Experiment
     ✔ science
   - Explanation
     ✔ science
   - Practical product
     ✔ technology
   - Testing
     ✔ both science and technology
   - Test—Does it work?
     ✔ technology
   - Test—Do other scientists agree it is correct?
     ✔ science

2. **Have the students read part one of Carey's Garden. Use the advance organizers found at the beginning of each section of the book to help guide the discussion.**

   Ask such questions as these:
   - What do you like about the story?
   - What jokes did you find?
   - Do you know anyone who is like Carey? Clarisse? Kim?
   - How would you describe Carey? Clarisse? Kim?

3. **Have the students read the advance organizers as they come to the beginning of each of the remaining sections. Have them develop a list of questions they think will be answered as they read further.**

   In each discussion include
   - Interpretation of the advance organizers.
   - Their questions.
   - Additional characteristics of science and technology on the concept map.

4. **Summarize the activity by having the class create Working definitions of sceince and technology. Record their definitions in the Working Dictionary.**

   Help them include such ideas as
   - Science involves trying to find explanations for things that happen.
   - Science involves experimenting.
   - Science involves trying to find out whether our explanation allows us to make correct predictions.
   - Who are scientists?
     ✔ Biologists, chemists, astronomers, physicists, meteorologists, etc.
   - Technology involves trying to find practical solutions to problems.
   - Technology involves making or doing the things that provide practical solutions to problems.
   - Technology involves testing things that offer solutions to problems to see whether they work.
   - Who are technologists?
     ✔ Engineers, auto mechanics, welders, farmers, cooks, gardeners, salespeople, etc.

5. **Have the students record their ideas about science and technology in the Connections Book.**

Ask such questions as these:
- Where are science and technology used in school? Out of school?
- How do science and technology help us in school? Out of school?

EXTENSIONS

Have the students
- Make a book of news articles and stories about what scientists and technologists do.
- At the end of each article indicate why the person or people are considered to be scientists or technologists. Use SP 3.1.12 SCIENTIST OR TECHNOLOGIST?

3.1.13 CONCEPT AND SKILL INVENTORY

OBJECTIVES

The students

- Assess their own understanding of the concepts taught in grade three.
- Assess their own ability to perform the skills taught in grade three.
- Describe, demonstrate, or teach their knowledge of concepts.
- Demonstrate their ability to perform or teach skills.

BACKGROUND

This activity is a continuation of the DASH evaluation component that begins in kindergarten and extends through grade six. It is designed to engage the students in becoming aware of the concepts they understand and the skills they have mastered. The instrument used is called a Concept and Skill Inventory.

In DASH the term **concept** includes a whole array of connections and ideas associated with a particular word or phrase. The term **skill** means the ability to do something. Concepts and skills develop with the student. A third grader's concept of energy will be far broader than that of a kindergartner. Likewise, a third grader's skill in measuring volume will exceed that of a kindergartner.

The evaluation of concepts and skills uses three levels of discrimination.

CONCEPTS	SKILLS
I do not understand the concept.	I cannot carry out the skill.
I understand the concept.	I can carry out the skill.
I can teach someone else the concept.	I can teach someone else the skill.

It is suggested that the teacher independently rate each student's mastery. After the teacher and the students have completed their ratings, the teacher can resolve discrepancies by discussing them with the students. At the level of understanding the students can be asked what they know about a concept. At the teaching level they can be

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asked to teach the teacher the concept. In DASH teaching is seen as the highest level of achievement. The students should be constantly striving to gain the capacity to teach someone else both concepts and skills. In the case of skills, the students' ability to perform or carry out a given skill can be directly tested by giving them a task involving the skill.

In a given year the students may not explore all the concepts and skills listed on the inventory. This list is a representative sample of the many concepts and skills that are addressed in the DASH materials. The teacher should add or subtract as appropriate to each year's class.

The Concept and Skill Inventory, the Suggested Script, and the Teacher Evaluation appear in the Teacher's Guide following this activity. The Inventory and the Teacher Evaluation are also included with the blackline masters. Each student will need a copy of the Inventory. Make enough copies of the Teacher Evaluation to accommodate the number of students in the class. The Concept and Skill Inventory can be used as both a reporting mechanism for parents and for administrative purposes.

STUDENT ROLE

Evaluator

MATERIALS

suggested script for administering the Concept and Skill Inventory
teacher evaluation
Student Page 3.1.13 CONCEPT AND SKILL INVENTORY

PRODUCT

Completed Concept and Skill Inventories

PROCEDURES

1. **Explain the purpose of the Concept and Skill Inventory to the students.**

   Include such things as the evaluation
   - Allows students to tell what they think they know.

   - Allows teachers to check their observations with students.

- Shows what yet needs to be mastered or understood.

2. **Go over examples of what is meant by each level of the Inventory. Read the concepts and skills where necessary and have the students circle their level of understanding and mastery.**

3. **Discuss with individuals differences in teacher and student perception of mastery and understandings.**

SUGGESTED SCRIPT
DASH Grade Three Concept and Skill Inventory

CONCEPTS:

There are three possible answers to each of the following questions: **No**, I do not know what the word means. **Yes**, I do know what the word means. And, I can **teach** the meaning of this word to a friend who does not know its meaning. Please circle ONE answer only: **no**, **yes**, or **teach**.

1. Do you know what a friend is and how to be one? ...NO, I do not know what a friend is; YES, I do know what a friend is; or I can TEACH the meaning of friend to a student who does not know what a friend is. Put a circle around your best answer.
2. Do you know what a goal is? Continue as above until all the students understand the pattern.
3. Do you know what rules are and why we have them?
4. Do you know what an aphorism is?
5. Do you know what science is?
6. Do you know what technology is?
7. Do you know what weather is?
8. Do you know what an humidity is and how we measure it?
9. Do you know what an equinox is?
10. Do you know what a solstice is?
11. Do you know what a constellation is?
12. Do you know what a planet is?
13. Do you know what an eclipse is?
14. Do you know about metamorphosis?
15. Do you know what a nymph is?
16. Do you know what pupa is?
17. Do you know what a larva is?
18. Do you know what a tadpole is?
19. Do you know what a microhabitat is used for?
20. Do you know about insect control?
21. Do you know the parts of a flower?
22. Do you know what a seed is?
23. Do you know what artificial soil is?
24. Do you know about germination?
25. Do you know what good nutrition means?
26. Do you know about the food groups ?
27. Do you know about food preservation?
28. Do you know what a consumer does?
29. Do you know what a food processor does?
30. Do you know what growth means?

31. Do you know how breathing works?
32. Do you know what an artery is?
33. Do you know what a vein is?
34. Do you know how your heart works?
35. Do you know how your lungs work?
36. Do you know about disease transmission?
37. Do you know what a microorganism is?
38. Do you know what medicine is used for?
39. Do you know about sanitation?
40. Do you know how a propeller works?
41. Do you know what a heliograph is?
42. Do you know what communication is?
43. Do you know about different kinds of energy?
44. Do you know what compost is?
45. Do you know what decomposition is?
46. Do you know how to recycle things?
47. Do you know what conservation means?
48. Do you know what an acid is?
49. Do you know what a base is?
50. Do you know what a solution is?
51. Do you know how to dissolve something?
52. Do you know what a reaction is?
53. Do you know what evaporate means?
54. Do you know what dilute means?
55. Do you know what concentrate means?
56. Do you know how to neutralize something?
57. Do you know what saturated means?
58. Do you know what a solid is?
59. Do you know what a liquid is?
60. Do you know what a gas is?
61. Do you know how to make a crystal?
62. Do you know what moisture is?
63. Do you know how to find the area of something?
64. Do you know how to find the volume of something?
65. Do you know about safety?

SKILLS:

1. Do you know how to cooperate? ...NO, I do not know how to cooperate,
   YES, I know how to cooperate, or I can TEACH a friend how to cooperate who does not know about cooperating. Put a circle around your best answer.
2. Do you know how to observe something? ...NO, YES, or I can TEACH a friend how to observe something who does not know about observation.
3. Do you know how to record data? Continue as above if necessary.
4. Do you know how to make a graph?
5. Do you know how to make a map?
6. Do you know how to measure temperature?
7. Do you know how to measure distance? (length)
8. Do you know how to measure volume? (liquids)
9. Do you know how to measure mass? (weight)
10. Do you know how to measure area?
11. Do you know how to measure time?
12. Do you know how to find direction?
13. Do you know how to predict things?
14. Do you know how to make and use a plan?
15. Do you know how to invent something?
16. Do you know how to construct things?
17. Do you know how to classify things? (sort or group)
18. Do you know how to make a working definition or define things?
19. Do you know now to make connections?
20. Do you know how to make a report on something you have done or found out?
21. Do you know how to organize things?
22. Do you know how to make a concept map about something?

DASH Grade Three Concept and Skill Inventory

Name: ______________________________

Date: ______________________________

1.	friend	no	yes	teach
2.	goal	no	yes	teach
3.	rule	no	yes	teach
4.	aphorism	no	yes	teach
5.	science	no	yes	teach
6.	technology	no	yes	teach
7.	weather	no	yes	teach
8.	humidity	no	yes	teach
9.	equinox	no	yes	teach
10.	solstice	no	yes	teach
11.	constellation	no	yes	teach
12.	planet	no	yes	teach
13.	eclipse	no	yes	teach
14.	metamorphosis	no	yes	teach
15.	nymph	no	yes	teach
16.	pupa	no	yes	teach
17.	larva	no	yes	teach

18.	tadpole	no	yes	teach
19.	microhabitat	no	yes	teach
20.	insect control	no	yes	teach
21.	flower	no	yes	teach
22.	seed	no	yes	teach
23.	artificial soil	no	yes	teach
24.	germinate	no	yes	teach
25.	nutrition	no	yes	teach
26.	food groups	no	yes	teach
27.	food preservation	no	yes	teach
28.	consumer	no	yes	teach
29.	food processor	no	yes	teach
30.	growth	no	yes	teach
31.	breathing	no	yes	teach
32.	artery	no	yes	teach
33.	vein	no	yes	teach
34.	heart	no	yes	teach
35.	lung	no	yes	teach
36.	disease transmission	no	yes	teach
37.	microorganism	no	yes	teach
38.	medicine	no	yes	teach
39.	sanitation	no	yes	teach

40.	propeller	no	yes	teach
41.	heliograph	no	yes	teach
42.	communication	no	yes	teach
43.	energy	no	yes	teach
44.	compost	no	yes	teach
45.	decomposition	no	yes	teach
46.	recycle	no	yes	teach
47.	conservation	no	yes	teach
48.	acid	no	yes	teach
49.	base	no	yes	teach
50.	solution	no	yes	teach
51.	dissolve	no	yes	teach
52.	reaction	no	yes	teach
53.	evaporate	no	yes	teach
54.	dilute	no	yes	teach
55.	concentrate	no	yes	teach
56.	neutralize	no	yes	teach
57.	satuated	no	yes	teach
58.	solid	no	yes	teach
59.	liquid	no	yes	teach
60.	gas	no	yes	teach

61.	crystal	no	yes	teach
62.	moisture	no	yes	teach
63.	area	no	yes	teach
64.	volume	no	yes	teach
65.	safety	no	yes	teach

Skills

Name: ____________________

Date: ____________________

1.	cooperate	no	yes	teach
2.	observe	no	yes	teach
3.	record	no	yes	teach
4.	graph	no	yes	teach
5.	make a map	no	yes	teach
6.	measure temperature	no	yes	teach
7.	measure distance	no	yes	teach
8.	measure volume	no	yes	teach
9.	measure mass	no	yes	teach
10.	measure area	no	yes	teach
11.	measure time	no	yes	teach
12.	find direction	no	yes	teach
13.	predict	no	yes	teach
14.	plan	no	yes	teach
15.	invent	no	yes	teach
16.	construct	no	yes	teach
17.	classify	no	yes	teach
18.	define	no	yes	teach
19.	make connections	no	yes	teach

20.	report	no	yes	teach
21.	organize	no	yes	teach
22.	make a concept map	no	yes	teach

GRADE 3 TEACHER ASSESSMENT (Page 1)

KEY N = No Y = Yes T = Teach															
1. friend															
2. goal															
3. rule															
4. aphorism															
5. science															
6. technology															
7. weather															
8. humidity															
9. equinox															
10. solstice															
11. constellation															
12. planet															
13. eclipse															
14. metamorphosis															
15. nymph															
16. pupa															
17. larva															
18. tadpole															
19. micro habitat															
20. insect control															
21. flower															
22. seed															
23. artificial soil															
24. germinate															
25. nutrition															
26. food groups															
27. food preservation															

GRADE 3 TEACHER ASSESSMENT (Page 2)

KEY N = No Y = Yes T = Teach															
28. consumer															
29. food processor															
30. growth															
31. breathing															
32. artery															
33. vein															
34. heart															
35. lung															
36. disease transmission															
37. microorganism															
38. medicine															
39. sanitation															
40. propeller															
41. heliograph															
42. communication															
43. energy															
44. compost															
45. decomposition															
46. recycle															
47. conservation															
48. acid															
49. base															
50. solution															
51. dissolve															
52. reaction															
53. evaporate															
54. dilute															

GRADE 3 TEACHER ASSESSMENT (Page 3)

KEY N = No Y = Yes T = Teach															
55. concentrate															
56. neutralize															
57. saturated															
58. solid															
59. liquid															
60. gas															
61. crystal															
62. moisture															
63. area															
64. volume															
65. safety															

GRADE 3 TEACHER ASSESSMENT (Page 4)

KEY N = No Y = Yes T = Teach															
1. cooperate															
2. observe															
3. record															
4. graph															
5. make a map															
6. measure temperature															
7. measure distance															
8. measure volume															
9. measure mass															
10. measure area															
11. measure time															
12. find direction															
13. predict															
14. plan															
15. invent															
16. construct															
17. classify															
18. define															
19. make connections															
20. report															
21. organize															
22. make a concept map															

SP 3.1.1

DASH

CALENDAR REVIEW
SP 3.1.1

Name: ____________________

Date: ____________________

HOW MANY DAYS?	HOW MANY WEEKS?	HOW MANY MONTHS?	HOW MANY SEASONS?	HOW MANY MOON CYCLES?

HOTTEST DAY

DATE: ____________________

TEMPERATURE: _____ °C _____°F

COLDEST DAY

DATE: ____________________

TEMPERATURE: _____ °C _____°F

SUMMER SOLSTICE

DATE: ____________________

SUNRISE: ______ SUNSET: ______

WINTER SOLSTICE

DATE: ____________________

SUNRISE: ______ SUNSET: ______

FALL EQUINOX

DATE: ____________________

SUNRISE: ______ SUNSET: ______

SPRING EQUINOX

DATE: ____________________

SUNRISE: ______ SUNSET: ______

MOST HUMID DAY

DATE: ____________________

TEMPERATURE: _____ °C _____°F

COBALT CHLORIDE

PAPER COLOR: ____________________

LEAST HUMID DAY

DATE: ____________________

TEMPERATURE: _____ °C _____°F

COBALT CHLORIDE

PAPER COLOR: ____________________

Group Question: ____________________

What was discovered?

DASH

QUESTIONS
SP 3.1.2

Name: ______________________

Date: ______________________

QUESTIONS I WANT TO INVESTIGATE

DASH

HOME RESPONSIBILITIES SP 3.1.3

Name: ______________________

Date: ______________________

JOB	DATES									

DASH

MONTHLY PLANNING CALENDAR
SP 3.1.4

Name: ____________________

Date: ____________________

Month:

Sun	Mon	Tues	Wed	Thurs	Fri	Sat

DASH

ORGANIZING
SP 3.1.5

Name: ______________________

Date: ______________________

A Plan for Organizing ______________________________________

Planning Group: ______________________ ______________________

______________________ ______________________

DASH

FRIENDS
SP 3.1.6A

Name: ______________________

Date: ______________________

FRIENDS

DASH

FRIENDS
SP 3.1.6B

Name: ______________________

Date: ______________________

RIGHT
THINGS
TO DO

DASH

FRIENDS
SP 3.1.6C

Name: ____________________

Date: ____________________

WRONG THINGS TO DO

DASH

KINDS OF GIVING AND RECEIVING
SP 3.1.7A

Name: ______________________

Date: ______________________

KIND OF GIFT	WHY THE GIFT IS GIVEN	RECEIVER OF THE GIFT

DASH

FEELINGS ABOUT GIVING AND RECEIVING
SP 3.1.7B

Name: ______________________

Date: ______________________

BEING A GIVER	
POSITIVE FEELINGS	NEGATIVE FEELINGS

BEING A RECEIVER	
POSITIVE FEELINGS	NEGATIVE FEELINGS

DASH

PERSONAL GIVING AND RECEIVING
SP 3.1.7C

Name: ____________________

Date: ____________________

Make a list of the ways you can personally give and receive in a positive manner.

DASH

WORKING TOGETHER: REASONS
SP 3.1.8A

Name: ____________________

Date: ____________________

REASONS FOR WORKING IN GROUPS	REASONS FOR WORKING INDIVIDUALLY

DASH

WORKING TOGETHER: DECISIONS
SP 3.1.8B

Name: ______________________

Date: ______________________

PROJECT: ______________________

LIST OF REASONS FOR WORKING IN A GROUP	LIST OF REASONS FOR WORKING INDIVIDUALLY

DECISION: ☐ IN A GROUP

☐ INDIVIDUALLY

DASH

HELPING MYSELF AND OTHERS SP 3.1.9

Name: ____________________

Date: ____________________

HOW OFTEN DO I DO IT?	ALWAYS	2nd SEM						
		1st SEM						
	SOME	2nd SEM						
		1st SEM						
	NEVER	2nd SEM						
		1st SEM						
CAN I DO IT?	TEACH	2nd SEM						
		1st SEM						
	YES	2nd SEM						
		1st SEM						
	NO	2nd SEM						
		1st SEM						
GOALS								
			FOR HELPING MYSELF			FOR HELPING OTHERS		

SP 3.1.10–1

DASH

APHORISMS
3.1.10 Page 1

Name: ______________________

Date: ______________________

APHORISMS	UNDERSTAND			USE		
	YES	NO	TEACH	NO	SOME	ALL
1. Eat the basic three, in a wide variety.						
2. Slow down sugar, Slow down fat, A dash of salt is enough of that.						
3. Sleep for eight, Wake up feeling great.						
4. Six glass in winter and eight in summer are my body's natural plumber.						
5. Wash hands before eating or fixing a hurt, After using the toilet or working in dirt.						
6. Someone else's dishes Are someone else's germs.						

SP 3.1.10–2

DASH

APHORISMS
3.1.10 Page 2

Name: ______________________

Date: ______________________

APHORISMS	UNDERSTAND			USE		
	YES	NO	TEACH	NO	SOME	ALL
7. Brush twenty times up And twenty times down, Inside, outside, all around. Floss in between To complete the routine.						
8. Healthy skin and hair Is clean skin and hair.						
9. Winter clothes feel comfortably warm. Summer clothes feel comfortably cool.						
Wear white at night.						
10. When nature calls, Listen and go, Wipe and wash, And flush, just so.						
11. A clean and safe space, Is a great work place.						

DASH

APHORISMS
3.1.10 Page 3

Name: ____________________

Date: ____________________

APHORISMS	UNDERSTAND			USE		
	YES	NO	TEACH	NO	SOME	ALL
12. When you're sick stay at home. Don't let your germs roam						
13. Every wound requires inspection, Untreated wounds invite infection						
14. Don't sneeze or cough With the cover off.						
15. Sharing with others Is caring for others.						
16. Get the job done, Then have fun.						
17. Plan ahead						
18. Lend a hand, When you can.						
20. Remember 911 When emergencies Come.						

SP 3.1.10–4

DASH

APHORISMS
3.1.10 Page 4

Name: ____________________

Date: ____________________

APHORISMS	UNDERSTAND			USE		
	YES	NO	TEACH	NO	SOME	ALL
20. Play fair with others And they'll play fair with you.						
21. Finished for today? Then put your things away.						
22. Treat all living things with respect.						
23. Exercise 20 minutes for heart insurance. Thirty minutes for heart endurance.						
24. A smoker's a choker.						
There's no excuse for drug abuse.						
Alcohol makes your system stall.						
25. If you really know and understand, Teach and give someone a hand.						

DASH

LIBRARY CARD
SP 3.1.11

Name: ______________________

Date: ______________________

LIBRARY CODE

Title: ______________________

Author: ______________________

Subject: ______________________

Write a short description of the book

LIBRARY CODE

Title: ______________________

Author: ______________________

Subject: ______________________

Write a short description of the book

DASH

SCIENTIST OR TECHNOLOGIST?
SP 3.1.12

Name: ______________________

Date: ______________________

Attach the article in this space or tell what the story was about.

Tell why you think the person in this story is a scientist or a technologist.

Put this page in the SCIENCE AND TECHNOLOGY BOOK.

DASH

Concept and Skill Inventory
SP 3.1.13 Page 1
CONCEPTS

Name: ____________________

Date: ____________________

1. friend	no	yes	teach
2. goal	no	yes	teach
3. rule	no	yes	teach
4. aphorism	no	yes	teach
5. science	no	yes	teach
6. technology	no	yes	teach
7. weather	no	yes	teach
8. humidity	no	yes	teach
9. equinox	no	yes	teach
10. solstice	no	yes	teach
11. constellation	no	yes	teach
12. planet	no	yes	teach
13. eclipse	no	yes	teach
14. metamorphosis	no	yes	teach
15. nymph	no	yes	teach
16. pupa	no	yes	teach
17. larva	no	yes	teach

DASH

Concept and Skill Inventory
SP 3.1.13 Page 2
CONCEPTS

Name: ____________________

Date: ____________________

18. tadpole	no	yes	teach
19. microhabitat	no	yes	teach
20. insect control	no	yes	teach
21. flower	no	yes	teach
22. seed	no	yes	teach
23. artificial soil	no	yes	teach
24. germinate	no	yes	teach
25. nutrition	no	yes	teach
26. food groups	no	yes	teach
27. food preservation	no	yes	teach
28. consumer	no	yes	teach
29. food processor	no	yes	teach
30. growth	no	yes	teach
31. breathing	no	yes	teach
32. artery	no	yes	teach
33. vein	no	yes	teach
34. heart	no	yes	teach

DASH

Concept and Skill Inventory
SP 3.1.13 Page 3
CONCEPTS

Name: ____________________

Date: ____________________

35. lung	no	yes	teach
36. disease transmission	no	yes	teach
37. microorganism	no	yes	teach
38. medicine	no	yes	teach
39. sanitation	no	yes	teach
40. propeller	no	yes	teach
41. heliograph	no	yes	teach
42. communication	no	yes	teach
43. energy	no	yes	teach
44. compost	no	yes	teach
45. decomposition	no	yes	teach
46. recycle	no	yes	teach
47. conservation	no	yes	teach
48. acid	no	yes	teach
49. base	no	yes	teach
50. solution	no	yes	teach
51. dissolve	no	yes	teach

Concept and Skill Inventory
SP 3.1.13 Page 4
CONCEPTS

Name: ______________________

Date: ______________________

52. reaction	no	yes	teach
53. evaporate	no	yes	teach
54. dilute	no	yes	teach
55. concentrate	no	yes	teach
56. neutralize	no	yes	teach
57. saturated	no	yes	teach
58. solid	no	yes	teach
59. liquid	no	yes	teach
60. gas	no	yes	teach
61. crystal	no	yes	teach
62. moisture	no	yes	teach
63. area	no	yes	teach
64. volume	no	yes	teach
65. safety	no	yes	teach

DASH

Concept and Skill Inventory
SP 3.1.13 Page 5
SKILLS

Name: ____________________

Date: ____________________

1. cooperate	no	yes	teach
2. observe	no	yes	teach
3. record	no	yes	teach
4. graph	no	yes	teach
5. make a map	no	yes	teach
6. measure temperature	no	yes	teach
7. measure distance	no	yes	teach
8. measure volume	no	yes	teach
9. measure mass	no	yes	teach
10. measure area	no	yes	teach
11. measure time	no	yes	teach
12. find direction	no	yes	teach
13. predict	no	yes	teach
14. plan	no	yes	teach
15. invent	no	yes	teach
16. construct	no	yes	teach
17. classify	no	yes	teach

Concept and Skill Inventory
SP 3.1.13 Page 6
SKILLS

Name: ____________________

Date: ____________________

18. define	no	yes	teach
19. make connections	no	yes	teach
20. report	no	yes	teach
21. organize	no	yes	teach
22. make a concept map	no	yes	teach

DASH

GRADE THREE
CLUSTER 2

TIME, WEATHER, AND SKY

3.2.1 Weather
3.2.2 Temperature
3.2.3 Wind
3.2.4 Rain and Snow
3.2.5 Humidity
3.2.6 Sunrise and Sunset
3.2.7 Moon Phases
3.2.8 Polar Sky Model
3.2.9 Polar Constellations
3.2.10 Venus
3.2.11 Eclipses

3.2.1 WEATHER

OBJECTIVES

The students
- Invent logos to represent weather conditions.
- Record daily observations of general weather conditions.
- Compare their observations with newspaper reports.
- Make seasonal observations about general weather conditions.
- Create a working definition for weather.
- Connect the study of weather to their out-of-school environment.

BACKGROUND

This activity continues the study of general weather begun in kindergarten. The comparison of the students' perceptions of general weather conditions with newspaper accounts is emphasized in this activity along with the students' descriptive accounts of the seasons.

The students create logos to describe weather conditions to use on the Learning Calendar.

STUDENT ROLE

Meteorologist

MATERIALS

Learning Calendar
chart paper
markers
newspapers
Working Dictionary
Connections Book
Student Pages 3.2.1A WEATHER LOGOS
3.2.1B GENERAL WEATHER

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PRODUCTS

Class chart about weather logos
Weather data
Completed Student Pages

PROCEDURES

1. **Have the students invent logos to describe different weather conditions.**

   Have them
   - Use Student Page 3.2.1A WEATHER LOGOS.
   - Establish a standard range of temperatures and logos for cold, mild, and hot temperatures.
   - Include such weather types as clear, cloudy, partly cloudy, rainy, partly rainy, snowy, partly snowy, windless, windy, lightning, hail, foggy, smoggy, etc.
   - Make a Class chart weather logos and post it near the Learning Calendar.

2. **Have the students observe the weather each day and place an appropriate logo on the Learning Calendar.**

   Discuss the use of the logos by asking such questions as
   - When should we make our observations about the general weather conditions for the day?
   - When should we record our observation of the weather type, at the end, middle, or beginning of the day? Why?
     ✔ Help the students see that to appropriately categorize the weather for the day, the day's weather must run as much of its cycle as possible.
   - How will we resolve disagreement among observers?

3. **Have the students compare their weather observations with newspaper or TV generalizations.**

   Ask such questions as these:
   - How do our generalizations about the weather compare with the observations of the newspaper meteorologist or the TV weather reporter?
   - Why are there differences?
     ✔ Often local weather will differ widely from the broader generalization given by newspapers and TV.
   - Do we need to change the way we are reporting our weather?

4. **At the end of the fall season have the students characterize the season by counting the number of days with common weather conditions. Use Student Page 3.2.1B GENERAL WEATHER.**

   Discuss the seasonal data using questions such as
   - What was the most common kind of weather during the fall season?
   - What was the least common kind of weather?
   - What could we use as a general description of the weather for fall?

5. **Have the class characterize both winter and spring in the same way as fall and then compare their seasonal characterizations.**

6. **Have the students refine their previous working definition or create a new one for weather and record it in the Working Dictionary.**

7. **Have the class record their ideas in the Connections Book.**

   Ask such questions as these:
   - Who needs to know about weather?
   - Why is knowing about the weather important?
   - How can you use weather information?

EXTENSION

- Have the students develop their own questions and investigations about general weather conditions and seasons.

3.2.2 TEMPERATURE

OBJECTIVES

The students
- Measure and record early morning and noon temperatures.
- Compare newspaper high and low temperatures with the students' morning and noon recordings.
- Estimate temperatures.
- Determine their own temperature comfort range.

BACKGROUND

This activity continues the study of daily temperature. It provides a data base for establishing personal comfort conditions and for the continuing studies of seasons and animal behavior. Begin the activity as early in the school year as possible. Temperature data should be recorded in both Fahrenheit and Celsius.

STUDENT ROLE

Meteorologist

MATERIALS

Learning Calendar
chart paper
markers
thermometers
Student Page 3.2.2 TEMPERATURE

PRODUCTS

Concept map about temperature
Temperature data
Completed Student Pages

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PROCEDURES

1. **Have the class develop a concept map on the term temperature on chart paper.**

   Ask such questions as these:
   - What do temperature data tell us?
   - How do we measure temperature?
   - What kinds of things happen at different temperatures?
   - What does the temperature of our body tell us?
     ✔ Get at the idea of sickness and wellness.
   - What does the temperature of the air around us tell us?
     ✔ Work toward the idea of comfort.

2. **Have the students plan to collect temperature data.**

   Have them
   - Review and practice how to hold and read a thermometer.
     ✔ A thermometer should be held by the sides or the top. It should be read looking straight on at the mercury or alcohol level, not from above or below.
   - Decide where they are going to collect their outside air temperature data.
     ✔ Work toward an open area, shielded from wind and sun.
   - Review the difference between readings taken in direct sunlight and those taken in the shade.
     ✔ Students will recall that when the thermometer is in direct sunlight the temperature reading is considerably higher than when the thermometer is shielded from the sun and in contact only with the air.
   - Measure and record temperature twice a day—when they first come to school and around noontime.
   - Collect the previous day's high and low temperature data from the newspaper.
   - Record or post the newspaper data with the preceding day's temperature readings.

3. **Have the students compare their early morning and noon temperature data with the newspaper high and low data after several weeks of collection.**

   Ask such questions as these:
   - Which would you expect to be higher, the morning or noon temperature? Why?
   - How does the newspaper's report of high temperature compare to our noon reading?
     ✔ Usually they will be about the same unless there is a considerable difference in the altitude or other physical characteristics of the school site and the site where the newspaper data are collected.
   - How does the newspaper's report of low temperature compare to our morning reading?
     ✔ Again the similarity in data collection sites will determine the similarity in temperature data.
   - Why are the newspaper data a day late?

4. **Have the class repeat the comparison of newspaper and class temperature data in mid-winter and spring.**

   Ask such questions as these:
   - Are the high and low newspaper temperatures and our calendar morning and noon temperatures more alike in the winter, spring, or fall?
     ✔ Data will generally have about the same correlation.
   - Why do you think the noon reading is normally higher than the morning reading?

5. **As the year progresses have the students predict the air temperature before they take it so they discover the sensitivity of their bodies to differences in temperature.**

   After the students have gained some facility in predicting temperatures, ask them such questions as
   - How close have your predictions been?
     ✔ Some students will get to the point that when the air is still they can estimate within 2–5 degrees of the thermometer reading.
   - Which are easier to estimate, higher or lower temperatures?

6. **Have the students invent a way to determine at which temperature they feel most comfortable under different circumstances. Use Student Page 3.2.2 TEMPERATURE.**

Have them include such situations as when they are

- Inside a room in the winter.
- Inside a room in hot weather.
- Exercising or playing a game.

EXTENSION

- Have the students develop and investigate their own questions about temperature.

3.2.3 WIND

OBJECTIVES

The students
- Measure and record wind speed and direction each day.
- Determine the prevailing or most common wind direction.
- Compare wind speed and wind direction data between the seasons.

BACKGROUND

This activity continues the study of daily wind speed and direction. All information is recorded on the Learning Calendar. The data collected are used in the study of seasons and to correlate wind direction information with the movement of storms.

Wind speed is recorded using a modified version of the descriptive Beaufort Scale introduced in grade two. This scale along with a compass rose are provided on the student pages. Students use a magnetic compass to determine the placement of the compass rose to find wind direction. This is a good time to view the body compass rhyme and The Direction Song.

Right, rising east
Left, leaving west
Nose, north
Seat, south.
The sun is rising in the east, the east, the east.
The sun is rising in the west, the west, the west.
My nose is north,
My seat is south,
And I can turn myself about.
The sun is rising in the east and setting in the west.

The DASH compass is made by inserting a magnetized nail lengthwise into a cork and floating it in a plastic, aluminum, or glass pan filled with water.

The idea of prevailing or most common wind direction is introduced to students when they are first making wind direction determinations.

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STUDENT ROLES

Inventor
Meteorologist

MATERIALS

Learning Calendar
chart paper
markers
iron nail
magnet
cork
plastic, aluminum, or glass pan (6"–8" diameter)
dowels
string or yarn
fabric strips
pieces of board (6" x 6" to 12" x 12")
hammer
nails
tacks
craft sticks
straws
beads
pen caps
chopsticks
plastic, waterproof, and duct tapes
index cards
aluminum foil
plastic wrap
small pieces of flat plastic (can be cut from plastic bottles)
compass
Student Pages 3.2.3A THE BEAUFORT WIND SCALE
3.2.3B COMPASS ROSE
3.2.3C WIND SPEED AND DIRECTION

PRODUCTS

Concept map about wind
Wind detectors
Wind direction devices
Wind data
Completed Student Pages

PROCEDURES

1. **Review the the concepts of wind speed and direction. Have the class make a concept map on the term wind.**

   Ask such questions as these:
   - What do wind speed data tell us?
     ✔ Get at such ideas as the potential damage that wind can cause, how rapidly smoke will leave a place, how far an object will be moved horizontally when falling on a windy day–leaves, paper, etc.

   - What do we mean by wind direction?
     ✔ Get at the concept that wind direction tells the direction the wind is coming from.

   - What do wind direction data tell us?
     ✔ Get at such ideas as the direction that objects will be moved by the wind, the direction that clouds will move, the possible coming of a storm or clear weather.

   - How do we measure wind speed?

   - How do we determine wind direction?

2. **Have student groups invent wind detectors and wind direction finders from materials found in the Inventor's Box.**

   Have them
   - Test their inventions.

   - Modify their inventions as necessary.

   - Determine the placement of the compass rose on their wind detection device using a compass. See Student Page 3.2.3B COMPASS ROSE.

   - Invent logos to define Beaufort Wind Scale numbers on Student Page 3.2.3A THE BEAUFORT WIND SCALE.

3. **Have the students decide where they are going to collect wind speed and direction data.**

   - Help them to decide on an open area away from buildings that deflect the wind.

- Have them take wind speed and direction when they first come to school.

- Have them record the data on the Learning Calendar.

4. **Late in the fall have the class compare wind direction, speed, and related general weather data from the calendar. Use Student Page 3.2.3C WIND SPEED AND DIRECTION.**

Ask such questions as these:
- From what direction does the wind seem to come most of the time?
✔ Introduce the term "prevailing wind" if necessary.

- Is the direction of the wind the same when a storm is coming as when a storm is going away?

- What is the usual speed of the wind?

- When does the wind speed get very high?

5. **Have the students repeat the the comparison of data in mid-winter and spring using Student Page 3.2.3C WIND SPEED AND DIRECTION.**

Ask such questions as these:
- From which direction does the wind seem to come most of the time in this season?

- How does this compare with other seasons of the year?

- Is the direction of the wind the same when a storm is coming in this season as when a storm is going away?

- How does this compare with other seasons of the year?

- What is the usual speed of the wind in this season?

- How does this compare with other seasons of the year?

- When does the wind speed get very high in this season?

- How does this compare with other seasons of the year?

EXTENSION

- Have the students develop and investigate their own questions about wind speed and direction.

3.2.4 RAIN AND SNOW

OBJECTIVES

The students
- Invent devices to measure rain and snow.
- Measure and record the amounts of rain and snowfall.
- Determine the liquid equivalent of snow.

BACKGROUND

This activity continues the study of rain and snow begun in grade two. All information should be recorded on the Learning Calendar. Collected data are used in the discussion of seasons. This information also provides the opportunity to correlate wind direction information with the piling of snowdrifts.

In grade two students devised rain and snow gauges. This activity gives the students an opportunity to reinvent and modify rain and snow measuring devices.

Some students may not fully understand the rain-measuring concept. A simulation is used to review the idea that they are measuring the depth that the rain would stand on a flat surface if no water soaked into the ground or was lost to evaporation. This is a depth problem rather than a volume problem.

A rain gauge can be made using a tin can with straight sides and a dipstick or ruler to measure the liquid collected. Other inventions should be encouraged.

A snow gauge can simply be a marked stick or pole. This is pushed through the snow until it reaches a hard surface. The gauge may also be a permanent structure such as a post that has been previously graduated. Snow gauges can be made before or after it snows.

The water content of snow can be measured by filling a can with snow (without packing it down) to the same height as the depth registered on the snow gauge. This snow can then be melted to see how deep the water stands in the can. This tells the students how deep the water

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would have been if the snow had fallen as rain. The depth of the water from the melted snow becomes the standard for measuring snow. This method will account for different types of snowfall which have different amounts of water in equal units of volume.

STUDENT ROLES

Inventor
Meteorologist

MATERIALS

Learning Calendar
waterproof tape
waterproof markers
water sprinkling device
cookie cutters
tin cans and other straight-sided, flat-bottomed containers
pie or cake pans
pieces of board for gauge bases
assorted sticks, dowels, and rulers
Student Pages 3.2.3A RAIN GAUGE
3.2.3B SNOW GAUGE

PRODUCTS

Rain and snow data
Rain gauges
Snow gauges
Completed Student Pages

PROCEDURES

1. **Use a simulation to review how the amount of rainfall was measured in grade two.**

   - Have the students work outdoors or someplace where spilled water is not a problem.

   - Use a flat pan to represent a field on which rain falls.

   - Sprinkle water evenly over the field and measure the depth of the rainfall.

- Predict how deep the water would stand in a hypothetical rain gauge in the middle of the pan.

- Invent a way to test their predictions.
  ✔ Help the students sprinkle the water evenly over the surface of the pan and gauge and then measure and compare the depth of the water in the gauge and in the pan.

- Discuss how this simulation corresponds to measuring rainfall.

2. **Have the class discuss where rain gauges should be set up.**

   Help the students to consider such requirements as
   - Locating the gauge in an area where the rainfall will not be obstructed.
   - Protecting the gauge from vandalism.
   - Securing the gauge so that it cannot be knocked over.
   - Having access to the gauge so they are able to measure the amount of rain.

3. **Have the students invent, make, and set up one or more rain gauges using materials in the Inventor's Box. Have them measure and record rainfall data on the Learning Calendar.**

4. **If appropriate to the geographic area, review how the amount of snowfall was measured in grade two. Have the students invent and make snow gauges. Discuss where snow gauges should be set up.**

   Help the students consider
   - Finding a place that is protected from the wind.
   - Finding a place where there will be no unusual pile-up of snow.
   - Finding a place where the snow will not be compacted.

5. **Have the students invent a way to measure the amount of water in snow and record this on the Learning Calendar. Help the students see that when we melt snow we can measure the depth of the liquid so it can be compared with rain.**

Ask such questions as these:

- If we have one full can of snow, how many cans of the same size would we need to hold the water?
  ✔ The students will find they can hold all the water in the same can they collected the snow in since water occupies less space than snow.

- If the snow melted, what depth would the water measure in our rain gauge?
  ✔ Help the students see that it would be the same depth as that of the melted snow in their can.

- If the snow were several cans high, how could we measure how much rain this would equal?
  ✔ Get at the idea that they can multiply the height of the water in one can by the number of cans high the snow is if the snowfall has been of the same consistency.

EXTENSION

- Have students develop their own questions to investigate about rain and snow.

3.2.5 HUMIDITY

OBJECTIVES

The students
- Make daily observations of humidity.
- Invent a humidity-measuring device.
- Make seasonal observations about humidity.
- Relate humidity to personal comfort.
- Create a working definition for humidity.

BACKGROUND

The students begin the study of humidity in this activity. It follows Activity 3.10.9 RAIN IN A JAR in which the students discover that water is found in air. Cobalt chloride paper is used as a water indicator. Recording of humidity data is best begun in winter or early spring, when the air is still quite dry.

The students invent a protective container for a piece of cobalt chloride paper. The container might be a plastic bag with holes or a jar with holes in the lid. When the paper is blue, the air is dry; when it is pink, the air is very humid; and when it is purple, the air is mildly humid.

STUDENT ROLES

Inventor
Meteorologist

MATERIALS

cobalt chloride paper
jar with lid
plastic bag
Working Dictionary
Student Page 3.2.5 HUMIDITY

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PRODUCTS

Humidity data
Completed Student Pages

PROCEDURES

1. **Review with the students what happens when water evaporates from a surface.**

   Ask such questions as these:

   - Under what conditions will water leave a solution or something that is wet?
     ✔ Help the students recall that heat and sunlight will speed up the loss of water. In cooler places water will leave solutions and wet surfaces more slowly.

   - Where does the water go?
     ✔ Work toward the idea that water goes into the air.

   - What evidence do we have for the water being in the air?
     ✔ Recall that water was detected with cobalt chloride paper in Activity 3.10.9 RAIN IN A JAR.

   - Has anyone heard the word **humid**? What do you think it means?
     ✔ Expect such ideas as a feeling of stickiness, when sweat collects on our body, when it's very hot and muggy in the summer.

   - Does anyone have a humidifier at home?

   - What does a humidifier do?
     ✔ Work to the idea that it puts moisture into the air.

   - When do we use a humidifier?
     ✔ Get at the idea that humidifiers are used when the air is too dry.

   - Does anyone have a dehumidifier at home?

   - What does a dehumidifier do?
     ✔ Work to the idea that it takes water out of the air.

- When do we use a dehumidifier?
  ✔ Get at the idea that dehumidifiers are used when the air is too humid.

- Does anyone have an idea about what causes uncomfortable humidity?
  ✔ Work to the idea that too much moisture gets into the air.

- How might we tell when there is a lot of moisture in the air?
  ✔ Get at the idea of using cobalt chloride paper.

- What color is the cobalt chloride paper when it is dry?
  ✔ Blue

- What color do you think cobalt chloride paper will be in dry air?

- What color is cobalt chloride paper when it is wet?
  ✔ Pink

- What color do you think cobalt chloride paper will be in very humid air?
  ✔ Pink

- What color is the cobalt chloride paper when something is slightly moist?
  ✔ Purple

- What color do you think cobalt chloride paper will be in mildly humid air?
  ✔ Purple

2. **Have student groups invent ways to protect a piece of cobalt chloride paper so that it can be carried outside and observed without touching it.**

3. **Discuss with the class how humidity measures are to be made.**

   Ask such questions as these:
   - Where should we make our humidity measurements?

   - Should the measurements be made in the sun?
     ✔ This is a testable question, although logic suggests that the sun will probably dry out the paper.

- How long should the cobalt chloride be allowed to stand before a reading of the color is made.
  ✔ This is also a testable question.

- When should we take our measurements?
  ✔ This again is a testable question.

- Where shall we record our humidity data?
  ✔ On the calendar.

- How should we record the humidity data?
  ✔ By the color of the cobalt chloride paper.

4. **When the air becomes humid have the students keep a record of their comfort level, the temperature, and the humidity on Student Page 3.2.5 HUMIDITY.**

5. **At the end of the year discuss the students' comfort records. Make separate class bar graphs for dry, mildly humid, and very humid days. Show the number of students that feel comfortable at various temperature ranges. See Figure 3.2.5.**

   Ask such questions as these:
   - What happens to our feeling of being comfortable as the humidity increases?
   - Do people usually feel more uncomfortable at lower or higher temperatures when it mildly humid? When it is very humid?
   - What seasons seem to be the driest?
   - What seasons seem to be the most humid?

6. **Have the students create a working definition for humidity and record it in their Working Dictionary.**

EXTENSION

- Have the students develop their own questions about humidity and research them.

ILLUSTRATION

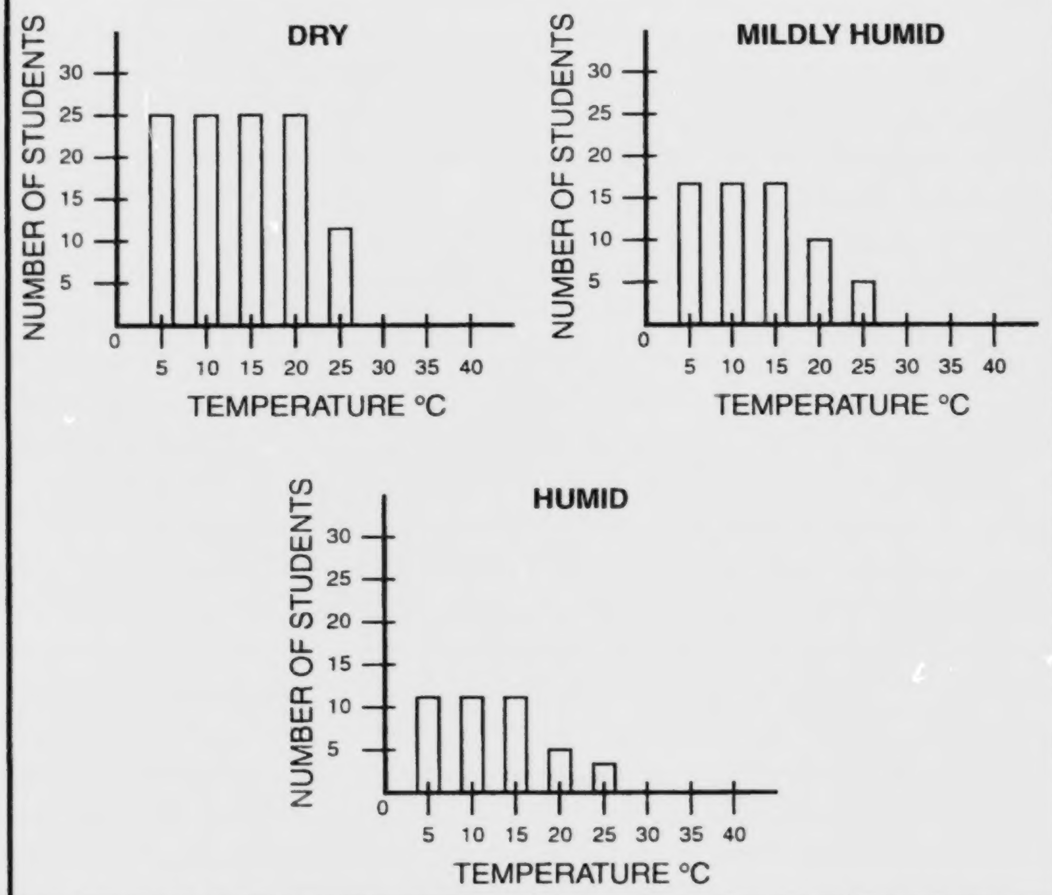

Figure 3.2.5 Examples of Comfort Level Bar Graphs showing the number of students in a class that felt comfortable at different temperatures and humidities.

3.2.6 SUNRISE AND SUNSET

OBJECTIVES

The students
- Determine the length of day and night.
- Predict the dates of equinoxes and solstices.
- Discuss the relationships between equinoxes and solstices and the seasons.

BACKGROUND

This activity should be started early in the school year since the fall equinox occurs on September 23rd. The students will need to collect some data prior to this date. They should record their information on the Learning Calendar.

In this activity the students determine the length of the night and the day once each week from newspaper or calendar data. They graph their data in a different way from previous years. They use a series of day and night clocks on heavy paper plates that they stack together to show the change in the length of day and night at different seasons of the year.

The students identify the **equinoxes** and **solstices**. The fall or autumnal equinox normally occurs on the first day of fall, September 23rd. The winter solstice is the first day of winter, usually December 22nd. The spring or vernal equinox is the first day of spring, March 21st. The summer solstice is the first day of summer, June 21st.

STUDENT ROLES

Astronomer
Mathematician

MATERIALS

thick paper plates
yellow and black marking pens
paper punch

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chart paper
yellow or white chalk or markers
blue or black chalk or markers
sunrise and sunset data
Student Page 3.2.6 PREDICTIONS

PRODUCTS

Day and Night Clock Graph
Completed Student Pages

PROCEDURES

1. **Have the class recall and discuss major solar-seasonal events.**

   Ask such questions as these:
   - Does anyone know what an equinox is?
     ✔ It is a day in the year when the hours of darkness and light are equal in length.
   - How can we find out when the next equinox is?
     ✔ Some possible answers are it will be announced on TV and radio and be in the papers. Work toward the idea that we can tell by measuring the length of night and day.
   - What is happening to the length of the day and the length of the night now?
     ✔ If it is the start of the school year, the day is getting shorter and the night is getting longer.
   - How can we predict when the fall equinox will be?
     ✔ Explore the idea of collecting data and seeing how much closer the number of night and day hours are each day.

2. **Have the students collect sunrise and sunset data and invent a way to predict the fall equinox.**

   Have them
   - Record the time of sunrise and sunset on the Learning Calendar.
   - Record their predictions on Student Page 3.2.6 PREDICTIONS.
   - Predict after a week or so when the fall equinox will be.

- Revise their predictions once a week until the fall equinox occurs.

3. Once each week throughout the school year have the class make a Day and Night Clock for their Clock Graph.

Have them
- Make a 24-hour clock to use as a template.
  ✔ Holes can be punched or notches cut in the template at each hour mark so the plates will line up accurately.

- Make a 24-hour clock once each week on the same day.

- Date the clocks and put them near the calendar. See Figure 3.2.6 (1).

- Put the clocks on a stick to make a Day and Night Clock Graph. See Figure 3.2.6 (2).

4. Have the students predict the occurrence of the winter solstice, the vernal or spring equinox, and the summer solstice. Help them work through the following inquiry. Draw the diagram in Figure 3.2.6(3) on the board or chart paper. Begin with the two parallel horizontal sunrise lines and the vertical fall equinox line.

Ask questions such as the following
- What part of the day does the yellow (or white) represent?
  ✔ Help the students to see yellow or white as daylight and blue or black as night.

- Where would sunset be?
  ✔ The point between the yellow day and the blue night.

- When the two lines are equal what occurs?
  ✔ The fall and spring equinoxes.

- What will happen to the length of the night and day lines about a month after the equinox?
  ✔ Help establish the convention that time is displayed from left to right, the same as in reading. Have a student draw a yellow and blue vertical line somewhere to the right of the fall equinox line.

- What is happening to the time of sunset each day?
  ✔ It gets closer to the upper sunrise, as the days get shorter. Have a student show this line of sunsets. Have another student fill in the day part between the sunset line and the sunrise line with white or yellow chalk.

- What will happen if the days just continue to get shorter?
  ✔ Get at the idea that we would have only night. Have a student show the sunset going off the top of the graph leaving only night.

- If this happened would there be any sunrise?
  ✔ Work for the idea that if there is no day there would be neither sunrise or sunset.

- Does that ever happen?
  ✔ Only in the Arctic and Antarctic Circles, not where most people live.

- What does happen?
  ✔ Work to the idea that after a certain time the days stop getting shorter. Have a student draw this on the graph.

- What is the name of the day when this change occurs?
  ✔ If necessary identify the term winter solstice as the day with the longest night.

- Then what happens to the length of the day and night?
  ✔ Work to the idea that the days start to get longer and the nights shorter. Have a student draw this on the graph.

- What will happen if the days just keep getting longer and longer?
  ✔ Work toward the idea that we would have all day. Have a student show the sunset going off the bottom of the graph.

- If this happened would there be any sunrise?
  ✔ Work toward the idea that if there is only day there would be neither sunrise or sunset.

- Does this ever happen?
  ✔ Only in the Arctic and Antarctic Circles, not where most people live.

- What does happen?
  ✔ Work to the idea that after a certain time the nights stop getting shorter. Have a student draw this on the graph.

- What is the name of the day when this occurs?
  ✔ If necessary identify the term summer solstice as the day with the shortest night.

- Then what happens to the length of the day and night?
  ✔ Work to the idea that the days start to get shorter and the nights longer. Have a student draw this on the graph.

- When do the days stop getting shorter?
  ✔ Help the students see that there is a cycle that goes to the next winter solstice.

- What happens halfway between the winter solstice and the summer solstice?
  ✔ Help the students observe that day and night again are equal. Have a student find the midpoint and identify it as the spring equinox.

5. **Have the students predict the dates of the winter solstice, the vernal or spring equinox, and the summer solstice.**

Have them
- Label the months on the Months and Seasons of the Year Clock on Student Pages 3.2.7 PREDICTIONS.

- Invent their own mnemonic to remember the sequence of months.

6. **Help the class go through the following inquiry to predict the beginning date of each season.**

Ask such questions as these:
- Can you find approximately where September 23 is on your Months and Seasons of the Year Clock?
  ✔ Have the students find and mark the approximate position.

- How could you fold your calendar to locate the day that comes half a year after September 23rd?
  ✔ Help them see that they can fold the calender in half with September 23 being the fixed point.

- How many days are there in an ordinary year?
  ✔ A good math correlation is to have the students add up the number of days on a calendar. If the year is a leap year, use the previous year's calendar. Work for 365.

- How many days are there in half a year?
  ✔ Work to 182-1/2.

- How many days are there in a quarter year?
  ✔ Work to 91-1/4.

- What fraction of the year would you expect days to get longer and what fraction of the year would you expect them to get shorter?
  ✔ If the cycle is regular, about half would be getting longer and half shorter.

- About where would the equinox be?
  ✔ If the cycle is regular, halfway between the two solstices.

- How would you fold your calendar to locate the the solstices?

- How many days are there from September 23 to the winter solstice?
  ✔ Work to 91-1/4.

- On what day would you expect the winter solstice to occur?

- On what day would you expect the vernal or spring equinox to occur?

- On what day would you expect the summer solstice to occur?

- On what day would you expect the next autumnal or fall equinox to occur?

7. **Have the students validate their dates as the year progresses.**

8. **Have the class analyze the data on the Day and Night Clock Graph.**

Ask such questions as these:
- Where are the equinoxes?
  ✔ Locate and mark the plates nearest the fall and spring equinoxes.

- Where is the winter solstice?
  ✔ Locate and mark the plate nearest the winter solstice.

- What does the clock graph tell us about seasons?

- What does the clock graph tell us about night and day?

- What does the clock graph help us predict about next summer?

EXTENSION

- Have the students ask and investigate their own questions about day and night, calendars, and seasons. Record their questions and findings in the Wonder and Discover Book.

ILLUSTRATIONS

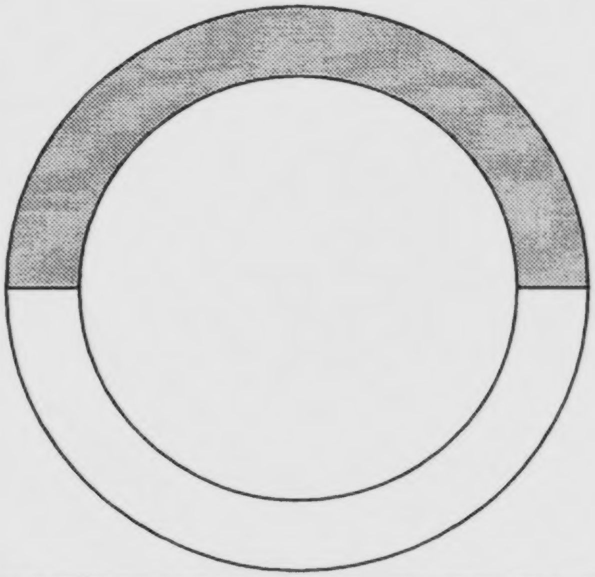

Figure 3.2.6(1) A 24-hour Day and Night Clock for the Fall Equinox

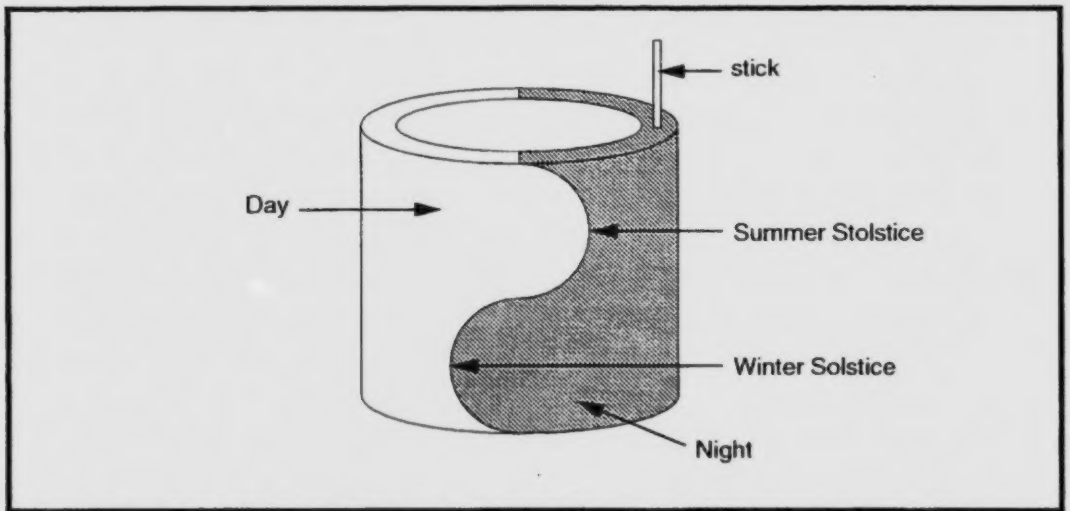
stick
Day
Summer Stolstice
Winter Solstice
Night

Figure 3.2.6(2) A 24-hour Day and Night Clock Graph for a Year

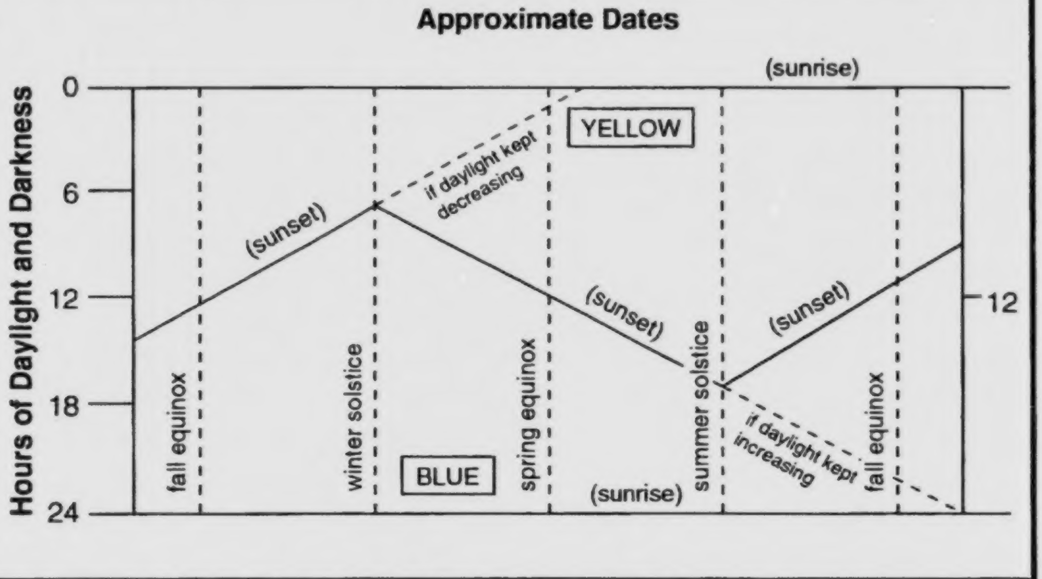

Figure 3.2.6(3) Sunrise and Sunset

3.2.7 MOON PHASES

OBJECTIVES

The students
- Graph moonrise and moonset.
- Determine the length of the moon cycle.
- Determine the length of each phase of the moon cycle.
- Verify their determinations.

BACKGROUND

In this activity the students determine the precise interval from one new moon to the next. The activity is introduced after several moon cycles have been recorded on the Learning Calendar and graphed as was done in grade two. Almanac and calendar data from previous years can alternatively be used to preserve the ongoing inquiry. Once the students make their predictions, they observe the phases of the moon. In previous grades students predicted the rise of the next new moon. In grade three they predict with greater precision.

This is an opportune time to learn the mnemonic:

> Thirty days has September,
> April, June, and November.
> All the rest have 31
> Save February's 28 days of fun.
> Leap year is filled out just fine
> When February gets 29.

The activity is introduced just prior to a new moon. The students are asked to predict when the next new moon will be. Counting the days from one new moon to the next will give 29 or 30 days. This provides an adequate way of predicting the beginning of the next moon cycle, but it also introduces an irregularity in a system that seems very regular. A solution to the problem is to average the time by counting the total number of days that it takes the moon to go through three to four cycles. This number is then divided by the number of cycles, giving an average of 29-1/2 days. The solution should be invented by the students. Verification comes by watching the moon through the

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next several cycles and by checking with resources such as a newspaper or almanac.

STUDENT ROLES

Astronomer
Mathematician

MATERIALS

Connections Book
Wonder and Discover Book
newspapers, almanac, or other source of moon data
Student Pages 3.2.7A MOON GRAPH
3.2.7B MOON PREDICTIONS

PRODUCT

Completed Student Pages

PROCEDURES

1. **Have the students make a class graph of moonrise and moonset for three or four cycles. Use SP 3.2.7A MOON GRAPH. Have them record moonrise and moonset times on the Learning Calendar.**

2. **Have the class predict the amount of time between new moons. Have them record their predictions on SP 3.2.7B MOON PREDICTIONS.**

   Ask such questions as these:
   - How did you make your predictions?
   - Do you think that the time between new moons is the same for each moon cycle?
   - How did the data collected so far this year help make predictions?
   - Can you invent a way to make more precise predictions about the next new moon using the data collected so far this year?

3. **Have student groups invent a way to predict when the next new moon will occur. Have them use almanac data, Student Page 3.2.7B MOON PREDICTIONS, the class moon graph, and data from the Learning Calendar.**

   Ask such questions as these:
   - What is your prediction of the amount of time between new moons?
     ✔ If a 29, 30, 29, 30, 29, 30 sequence of days and then a 29-1/2 day period evolve, have the students discuss their ideas. If only one of these solutions is suggested, continue with the following questions.
   - How can a pattern such as 29, 30, 29, 30 occur when the moon cycle seems so regular?
     ✔ Work toward the idea that maybe the moon takes a little longer than 29 days and a little less than 30 days.
   - If the moon took less than 30 and more than 29 days, what would the time be if the cycles were all the same?
     ✔ Get at the idea of 29-1/2 days.
   - In a 29-day cycle, how many days would there be between the first quarter, the full moon, the third quarter, and the new moon?
     ✔ 7-1/4 days.
   - In a 30-day cycle, how many days would there be between the first quarter, the full moon, the third quarter, and the new moon?
     ✔ 7-1/2 days.
   - In a 29-1/2 day cycle, how many days would there be between these phases of the moon?
     ✔ 7-3/8 days.

4. **Have the students verify their findings.**

   Have them
   - Predict the day beginning each of the phases in the coming moon cycle.
   - Predict the day of the next new moon.
   - Verify their predictions during the next cycle by observing the moon.

5. **Have the students discuss, observe, and test to discover answers to questions about the moon.**

   Include such questions as
   - When would it be best to travel at night if you had no artificial light?
   - Does the moon cast shadows at night? During all its phases?
   - How much of the time during a cycle is the moon in the sky in the day? At night?

6. **Have the students discuss the study of the moon cycle. Record their ideas in the Connections Book.**

   Ask such questions as these:
   - Who needs to know about the moon and its phases? Why?
   - How else do people use information about the moon?

EXTENSION

- Have students investigate their own questions about the moon phases. Record their questions and answers in the Wonder and Discover Book.

3.2.8 POLAR SKY MODEL

OBJECTIVES

The students
- make a model of the polar sky
- identify the constellations in the polar region
- develop a working definition for constellations

BACKGROUND

This activity provides students with a tool to begin the study of the stars and planets. It should be followed by Activity 3.2.9 POLAR CONSTELLATIONS. The students make the caps for the planetarium model that will be completed in DASH 4. POLAR SKY MODEL prepares the students for the next investigation, learning the location of the stars.

Two sizes of polar caps are provided. The large model is designed for class and small-group activities, and the small model for the students' personal use. Each student should have a copy of Student Page 3.2.8B SMALL POLAR SKY MODEL INSIDE VIEW to make a model for use at home. Print the copies on card stock to increase their durability. The students' model should be fastened with a paper clip that can be removed so the model can be carried easily and stored flat. The white outside margins of the models should be left blank until they are used in Activity 3.2.9 POLAR CONSTELLATIONS.

STUDENT ROLE

Astronomer

MATERIALS

scissors
glue
paper clips
Working Dictionary
Student Pages 3.2.8A LARGE POLAR SKY MODEL
3.2.8B SMALL POLAR SKY MODEL INSIDE VIEW

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PRODUCTS

Polar Sky Models
Completed Student Pages

PROCEDURES

1. **Introduce the study of the night sky to the students. Have student groups use Student Page 3.2.8A LARGE POLAR SKY MODEL to make large models for their groups.**

   Help them do the following:
   - Lay out the pages.
   - Trim and then glue the pages together onto a large sheet of chart paper.
   - Shape their models into a cap.

2. **Have the student groups study their Polar Sky Models.**

   Have them carry out the operations below:
   - Look at the model.
   - Locate the North Star or Polaris.
     ✔ It is located at the center of the cap.
   - Locate the Little Dipper or Ursa Minor.
     ✔ Polaris is the last star in the handle of the Little Dipper.
   - Locate the Big Dipper in Ursa Major.
     ✔ The Big Dipper is located close to the bowl of the Little Dipper.
   - Locate the pointer stars at the front edge of the Big Dipper and see how they are aligned with the North Star.
   - Locate other constellations shown on the model.
   - Discuss the meaning of the term "constellation."
     ✔ Work to the idea that it is a group of stars that have been given a name. Most constellation names are based on Roman and Greek mythology.

- Develop a working definition for constellations and record it in the Working Dictionary.

3. **Have the students make their personal models using Student Page 3.2.8B SMALL POLAR SKY MODEL.**

Have them do the following:

- Cut out the model.
- Use a paper clip to fasten it together.
- Find Polaris and the Dippers.

EXTENSION

- Have students research stories and myths about the constellations.

3.2.9 POLAR CONSTELLATIONS

OBJECTIVES

The students
- Use their polar sky model.
- Find the northern constellation in the night sky.
- Observe the apparent rotation of the constellations around the pole star.
- Identify the location of the constellations each month on their Polar Sky Model.

BACKGROUND

This activity causes the students to begin orienting themselves to the night sky. In urban areas this activity will be more difficult because of city lights. Brighter stars in the major constellations of the northern sky should be visible on a clear night away from direct street or house lights. It is suggested that a letter be sent to the parents about this activity since it is to be done at home.

An observation in the early evening shortly after twilight and another right before dawn will give a view of all the polar constellations in the night sky. This activity is done as an inquiry activity to help the students discover as much as they can on their own. It should be started in good weather, probably in the late fall or early spring when the nights are reasonably long and warm. The best viewing is when the moon is not in the night sky. The poorest viewing is when the moon is full.

STUDENT ROLE

Astronomer

MATERIALS

Polar Sky Models (See Activity 3.2.8 POLAR SKY MODEL.)
Working Dictionary
Student Pages 3.2.9A POLAR CONSTELLATIONS
3.2.9B SMALL POLAR SKY MODEL OUTSIDE VIEW

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PRODUCT

Completed Student Pages

PROCEDURES

1. **Help the students learn to orient their Polar Sky Models so they can find the polar constellations in the night sky.**

Have them do this:

- Face north using their body as a compass.
- Check their orientation using the Body Compass Rhyme or the Body Compass Song.

Body Compass Rhyme

Right rising east
Left leaving west
Nose north
Seat south

Body Compass Song
sung to the tune of *When Johnnie comes Marching Home*

The sun is rising in the east,
the east, the east.
The sun is setting in the west,
the west, the west.
My nose is north,
My seat is south,
And Earth can turn itself about.
The sun is rising in the east and
setting in the west.

- Hold the sky model so they are looking into the cap.
- Discuss how they could find north at night.
  ✔ True north will be along the line made by their body and the North Star. Help them to find the Dippers and the North Star at the end of the handle of the Little Dipper on the model. Point out that the front two stars of the Big Dipper are in line with the polar star.
- Discuss how they could see the model when it is dark.
  ✔ They will probably need to use a small flashlight to see their model.

2. **Discuss the directions for the night observation with the class. Have the students make their observations about 8 PM.**

   Have them try to do the following things:
   - Find the Big and Little Dippers.
   - Find the North Star.
   - Find where the Little Dipper is located in relation to the North Star.
     ✔ It will be above, below, or to the east or west side.
   - Find where the Big Dipper is in relation to the North Star.
     ✔ It will be above, below, or to the east or west side of the North Star.

3. **Discuss the first night observation with the class. Repeat the night observation and discussion if the students have trouble finding the Dippers and the North Star.**

   Ask such questions as these:
   - Did anyone find the North Star?
   - Can you describe how you found it?
   - What time did you make your observation?
   - What problems did you have?
   - Did anyone else have that problem? How did you solve it?
   - Did anyone find the Little Dipper?
   - Can you describe how you found it?
   - What time did you make your observation?
   - Where was the Little Dipper located in relation to the North Star?

The Little Dipper at 8 PM	
Month	Location
September	The Little Dipper is west of the North Star.
October	The Little Dipper is west and below the North Star.
November	The Little Dipper is west and below the North Star.
December	The Little Dipper is below the North Star.
January	The Little Dipper is below the North Star.
February	The Little Dipper is east and below the North Star.
March	The Little Dipper is east of the North Star.
April	The Little Dipper is east of the North Star.
May	The Little Dipper is east and above the North Star.
June	The Little Dipper is above the North Star.

- What problems did you have?
  ✔ Have the students solve each other's problems.
- Did anyone find the Big Dipper?
- Can you describe how you found it?
- What time did you make your observation?
- Where was the Big Dipper located in relation to the North Star?

The Big Dipper at 8 PM	
Month	Location
September	The Big Dipper is west and below the North Star.
October	The Big Dipper is below the North Star.
November	The Big Dipper is below the North Star.
December	The Big Dipper is east and below the North Star.
January	The Big Dipper is east of the North Star.
February	The Big Dipper is east of the North Star.
March	The Big Dipper is east and above the North Star.
April	The Big Dipper is above the North Star.
May	The Big Dipper is above the North Star.
June	The Big Dipper is west and above the North Star.

- What problems did you have?
  ✔ Have the students try to solve each other's problems.

- Did anyone use the model to help find the North Star and the Dippers? How did you use it?

4. **Have the students mark the month in the white space on the edge of their models to represent the night sky at 8 PM.**

   Have them do the following:
   - Orient their models toward the north.

   - Indicate the directions east and west.

   - Turn their models so the Dippers are located where they saw them at 8 PM.

   - In the space on their models directly above the North Star write the month and time (8 PM) that the observation was made.

5. **Discuss the directions for the morning observation with the class. Have the students make their observations about 5 AM.**

   Have them do the following:
   - Find the Big and Little Dippers.

   - Find the North Star.

   - Find where the Little Dipper is located in relation to the North Star.
     ✔ It will be above, below, or to the east or west side.

   - Find where the Big Dipper is in relation to the North Star.
     ✔ It will be above, below, or to the east or west side of the North Star.

6. **Discuss the results of the morning observation with the class. Repeat as necessary if the students have trouble making observations.**

   Ask such questions as these:
   - Did anyone find the North Star?

   - How did you find it?

- What time did you make your observation?
- What problems did you have?
  ✔ Have the students try to solve each other's problems.
- Did anyone find the Little Dipper?
- Can you describe how you found it?
- What time did you make your observation?
- Where was the Little Dipper located in relation to the North Star?

The Little Dipper at 5 AM	
Month	Location
September	The Little Dipper is east and above the North Star.
October	The Little Dipper is east of the North Star.
November	The Little Dipper is east of the North Star.
December	The Little Dipper is east and above the North Star.
January	The Little Dipper is above the North Star.
February	The Little Dipper is west and above the North Star.
March	The Little Dipper is west and above the North Star.
April	The Little Dipper is west of the North Star.
May	The Little Dipper is west and below the North Star.
June	The Little Dipper is west and below the North Star.

- What problems did you have?
  ✔ Have the students solve each other's problems.
- Did anyone find the Big Dipper?
- Can you describe how you found it?
- What time did you make your observation?
- Where was the Big Dipper located in relation to the North Star?

The Big Dipper at 5 AM	
Month	Location
September	The Big Dipper is east of the North Star.
October	The Big Dipper is east and above the North Star.
November	The Big Dipper is east and above the North Star.
December	The Big Dipper is above the North Star.
January	The Big Dipper is west and above the North Star.
February	The Big Dipper is west and above the North Star.
March	The Big Dipper is west of the North Star.
April	The Big Dipper is west and below the North Star.
May	The Big Dipper is below the North Star.
June	The Big Dipper is below the North Star.

- What problems did you have?
  ✔ Have the students try to solve each other's problems.

- Did anyone use the model to help find the North Star and the Dippers? How did you use it?

7. **After general agreement has been reached by the students about the position of the Dippers at 8 PM and 5 AM, have them use the model to observe the apparent movement of the sky during a twenty-four-hour day.**

Help the students to the following:

- Hold their models so the North Star is pointing north.
- Hypothesize how the Dippers move in the sky to get from their 8 PM position to their 5 AM position.
- Hypothesize how the stars **above** the North Star move during the period from 8 PM to 5 AM.
- Hypothesize how the stars **below** the North Star move during the period from 8 PM to 5 AM.
- Hypothesize whether there are stars that stay in the northern sky all night long and, if so, which stars they would be.
- Work in small groups to decide how they can test their hypotheses.
- Test their hypotheses and report on their results.

- Work to agreement on the apparent movement of the stars.
  ✔ If the viewer is facing north, the stars above the North Star will appear to move east to west, and those below the North Star will appear to move west to east.

- Work to agreement as to which of the stars are still visible in the morning.
  ✔ These include the North Star and the stars near it, including those in the Little Dipper. They also include the stars on or near the eastern horizon at 8 PM. These will be almost ready to set at 5 AM.

8. **Each month have a Sky Watch to locate the position of the Dippers at 8 PM and 5 AM. Have the students mark the month above the 8 PM position of the stars on their Polar Sky Models.**

Have them do the following:
- Hold their models toward the north.

- Turn their models so that the dippers are in the same place they saw them at 8 PM.

- Write the month and the 8 PM time on the blank edge of the model directly above the North Star.

9. **Summarize the polar sky observations with the class at the end of the school year.**

Ask such questions as these:
- How do the stars in the northern sky appear to move?
  ✔ Work to agreement that the stars above the North Star appear to move eat to west, and those below the North Star appear to move west to east.

- How does the 8 PM position of the Big Dipper appear to move each month?
  ✔ Work to an agreement that it appears to move in a counterclockwise direction, changing just a little each month.

- What do you think will happen to the movement of the 8 PM position of the Big Dipper during the summer?
  ✔ Have the students use Student Page 3.2.9A POLAR CONSTELLATIONS to record their predictions.

10. **Have the students revise their working definition of constellation and record it in their Working Dictionary.**

EXTENSIONS

- Have the students locate other constellations that are easy to distinguish such as Cassiopeia and Orion. Have them observe the apparent movement of these constellations.

- Have the students look at diagrams of the people, creatures, and things the ancients associated with the constellations of the northern sky. Have them use Student Page 3.2.9B SMALL POLAR SKY MODEL OUTSIDE VIEW. This fits on the outside of the small Polar Sky Model made in Activity 3.2.8 POLAR SKY MODEL.

3.2.10 VENUS

OBJECTIVES

The students
- Make concept maps about the planets.
- Record the rising and setting times of Venus.
- Observe Venus in the night and daytime sky.
- Practice using their fists to measure the distance of objects.

BACKGROUND

In this activity the students begin to orient themselves in the rest of the sky. Since much of this activity will be done at home, a letter should be sent home preceding its introduction. In this inquiry the students are encouraged to locate Venus on their own. The activity should be started in good weather in fall or spring when Venus is up since the students will need to be outside at night.

Venus is visible most of the time. It is most easily seen early in the evening or right before sunrise. Venus rises and sets fairly close to the time of sunrise and sunset in the same approximate place where the sun rises and sets. Information on its rising and setting is found in almanacs. Planets follow the same path as the sun, the moon, and the constellations of the zodiac across the sky.

To use almanac data on the rising and setting of planets the students need to know their latitude within 5°. Generally students in the U.S. living north of a line drawn along the northern boundaries of North Carolina, Tennessee, Arkansas, Oklahoma, New Mexico, and Arizona, continuing across the southern tip of Nevada, through central California, and ending just south of San Francisco can use 40° latitude data. Students located from the same boundary line south to the Mexican border can use 30° latitude data. Students in Washington, the northern tip of Idaho, northern Montana, North Dakota, and northern Minnesota should use 50° latitude data. Students in Hawaii can use the 20° latitude data.

Venus is the only planet studied in this activity. Other planets are introduced in grade four. However, as an extension of this activity,

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encourage students with a high level of interest to start observing other planets on their own. Mars, Jupiter, and Saturn are visible to the naked eye and can be easily observed.

STUDENT ROLE

Astronomer

MATERIALS

chart paper
markers
Wonder and Discover Book
Learning Calendar
almanac (photocopies of current Venus rising and setting data)
Connections Book
Student Page 3.2.10 VENUS

PRODUCTS

Concept maps on planets
Learning Calendar data
Completed Student Pages

PROCEDURES

1. **Have student groups make concept maps about the planets. Have them share and discuss their maps.**

   Ask such questions as these:
   - How is a planet like a star?
     ✔ Work to the idea that both shine as a speck of light in the night sky.

   - Can anyone name a planet?

   - Does anyone know the next brightest object in the sky after the sun and the moon?
     ✔ This information may have to be supplied. It is Venus.

   - Does anyone know how many planets there are?
     ✔ If no one knows, record this question in the Wonder and Discover Book and have the students do some research.

2. **Announce the beginning of a class Venus Watch. Help the students work through several examples using almanac data on Venus to see how to locate the planet in the sky.**

   Have them
   - Find the rising and setting times of Venus for the current date.
   - Start recording the rising and setting times of Venus on the Learning Calendar.
   - Determine whether Venus will be in the night or morning sky.
   - Find Venus in the sky for homework. Use the Finding Venus section of SP 3.2.10 VENUS.

3. **Have the class discuss their observations of Venus. Continue the Venus Watch until most students have found it.**

   Ask such questions as these:
   - Did anyone find Venus?
   - How did you find Venus?
   - What time was it when you found Venus?
   - What problems did you have?
   - Did anyone else have to solve that problem? How did you solve it?

4. **Have the class begin to search for Venus during the day.**

   - Start this when Venus rises in the morning.
   - Have the students determine what the latest time is that they can still see Venus in the morning and record that time on SP 3.2.10 VENUS.
   - Discuss their observations.

   Ask such questions as these:
   - What was the time when you last saw Venus?

- How close to the sunrise was this?
  ✔ The student may respond with a range of answers from right before sunrise to considerably after sunrise.

- Can Venus be seen when it is daylight?
  ✔ It is visible throughout the day during its brightest phases.

- Where might we look for Venus in the sky now?

5. **Introduce the fist as a measuring tool. Have the students use their fists to measure the distance between Venus and the Sun. Use SP 3.2.10 VENUS.**

Have them

- Go outside and stand in a line facing a distant object such as a tree or a building.

- Hold their fists at arm's length and measure the height of the distant object.

- Report how many knuckles high the object appears.
  ✔ Fists are piled one on top of another to measure tall objects.

- Verify that everyone gets about the same number of knuckles from the top to the bottom of the object.

- Measure other objects and verify that everyone is getting about the same answer for each.

- Measure the distance between the rising sun and their last glimpse of Venus using their fists at home.
  ✔ The rising sun can be safely **glimpsed** long enough to make the measurement. The sunlight reaching our eyes is less intense at sunrise and sunset than during the day.

- Compare their measurements of the distance between the sun and Venus.

- Work to an agreement on this measurement.
  ✔ This will vary from five fists to a few knuckles depending where Venus is in its movement around the sun.

- Look for Venus during the day using this measurement.
  ✔ Have the students use a piece of cardboard to protect their eyes from the sun. Measure the number of fists and knuckles in front of the sun to locate Venus.

6. Have the students invent a way to find Venus when it is following the sun in the sky.

7. Have the class discuss the importance of studying the objects in the sky. Record their ideas in the Connections Book.

Ask such questions as these:
- Who needs to know about what happens to the objects in the sky?

- How is this information used?

EXTENSIONS

Have the students
- Make a bulletin board about the planets.

- Collect articles about the planets.

- Look for other planets in the sky.

3.2.11 ECLIPSES

OBJECTIVES

The students
- Build a camera obscura or other sun-viewing device.
- Use the sun-viewing device to observe, draw, and time solar eclipses.
- Invent ways to observe, draw, and time eclipses of the moon.
- Create a working definition for eclipse.

BACKGROUND

In this activity the students prepare to observe, draw, and time eclipses of the sun and moon. They invent and build devices to do this.

Solar eclipses are produced during a new moon when the moon passes in front of the sun. They occur during daylight hours, often during school time. A **total eclipse**, the alignment of the sun and the moon so that the sun is completely blocked, is rare.

Partial eclipses in which the moon covers only part of the sun are relatively common. During the years students are in elementary school they will have several opportunities to observe partial eclipses. To observe the moon fully covering the sun, a person on earth must be in direct alignment with the sun and the moon. The path of proper alignment is quite narrow. Observers on either side of the path see a partial eclipse. Information on when and where eclipses will occur is found in almanacs, newspapers, science magazines, and the CRDG Science Newsletter.

Lunar eclipses occur during a full moon when the earth passes between the sun and the moon. They happen at night. Though more common than total solar eclipses, alignment of the sun, earth, and the moon for a total eclipse of the moon is relatively rare. Partial lunar eclipses are common. One technique to view an eclipse of the sun is to use a camera obscura. DASH students use this invention in grade two to observe the sun. The camera obscura is a pinhole camera that provides a sharp image. The longer the box used to make the camera is, the larger the image will be. The sun casts an image on the back of the camera that can be traced on paper. By using a large box students

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can put their head and hands inside it for viewing and drawing. It is important to keep all light out of the camera except what comes through the pinhole. This is done by using a thick, dark drape over the observer and covering any light spaces with duct tape.

Alignment of the camera is left to the invention of the students. Success will occur when the camera is positioned so that the base rests along a line cast by a stick with the pinhole pointed at the sun. See Figure 3.2.11 (1).

There are other other ways that an eclipse of the sun can be viewed. **Use caution** since with some methods there is a risk that students will look directly into the sun and potentially damage their eyes.

Eclipses of the moon can be recorded in several ways. Drawings can be made on plastic or cellophane sheets taped over a mirror or onto a glass window pane using overhead projector pens. The moon's eclipses can also be photographed directly. See Figure 3.2.11 (2).

STUDENT ROLE

Astronomer

MATERIALS

large cardboard box
duct tape
thick dark cloth
pencils
paper
watch
Working Dictionary
Connections Book
Student Page 3.2.11A SOLAR ECLIPSE
Student Page 3.2.11.B LUNAR ECLIPSE

PROCEDURES

1. **Have the students construct camera obscuras for viewing and drawing the stages of an eclipse of the sun.**

2. **Have the students practice using their camera obscuras.**

Ask such questions as these:
- What happens to the image as the screen is moved closer to the pinhole? Further away from the pinhole?

- How could you modify your camera to get a larger image?
- What happens as the inside of your camera gets darker?

- Can anyone see objects other than the sun? Can you see clouds? Trees?

- How could you modify your camera to get an even better image of these things?

- How did you set up your camera to get the image of the sun to fall on the back of your camera?

3. **Have the students watch the papers and look in almanacs to find out when the next solar eclipse will be visible in their geographic area.**

4. **Have the class use their camera obscuras and a watch to record a solar eclipse.**

Have them
- Time the eclipse from beginning to end.

- Trace the image of the sun during the eclipse at one-minute intervals.

- Record their data on Student Page 3.2.11A SOLAR ECLIPSE.
- Record the phase of the moon.

5. **Review the students' experience with the solar eclipse.**

Ask such questions as these:
- How could you tell when the eclipse started?

- How could you tell when the eclipse ended?

- How long did the eclipse take?

- How much of the sun was covered at the maximum point of the eclipse?

- How did this eclipse compare with other eclipses you have observed?
- What seems to be the relationship between an eclipse of the sun and the phase of the moon?

6. **Have student groups invent ways to view and draw the stages of a lunar eclipse.**

   Inventions may include
   - Cameras.
   - Systems using a pane of window glass or a mirror.

7. **Have the students practice using their devices before an eclipse is expected and share with the class what they have done.**

8. **Have the students watch the papers and look in almanacs to find out when the next lunar eclipse will be visible in their geographic area.**

9. **Have the class use their viewing devices and a watch to record a lunar eclipse.**

   Have them
   - Time the eclipse from beginning to end.
   - Trace the image of the moon during the eclipse at one-minute intervals.
   - Record their data on Student Page 3.2.11B LUNAR ECLIPSE.
   - Record the phase of the moon.

10. **Review the students' experience with the lunar eclipse.**

    Ask such questions as these:
    - How could you tell when the eclipse started?
    - How could you tell when the eclipse ended?
    - How long did the eclipse take?
    - How much of the moon was covered at maximum point of the eclipse?

- How did this eclipse compare with other eclipses you have observed?
- What was the phase of the moon? What seems to be the relationship between the lunar eclipse and the phase of the moon?

11. **Have the students create or refine their Working definition of eclipse and record it in their Working Dictionary.**

12. **Have the class record their ideas in the Connections Book.**

Ask such questions as these:

- Where else have you seen eclipses?
- Who else records information about eclipses?
- What could be learned by observing eclipses?
- Why might this information be important? Who might need to use this information?

EXTENSIONS

Have the students

- Read about how eclipses were viewed by people in ancient times.
- Find articles about why research scientists study eclipses.

ILLUSTRATIONS

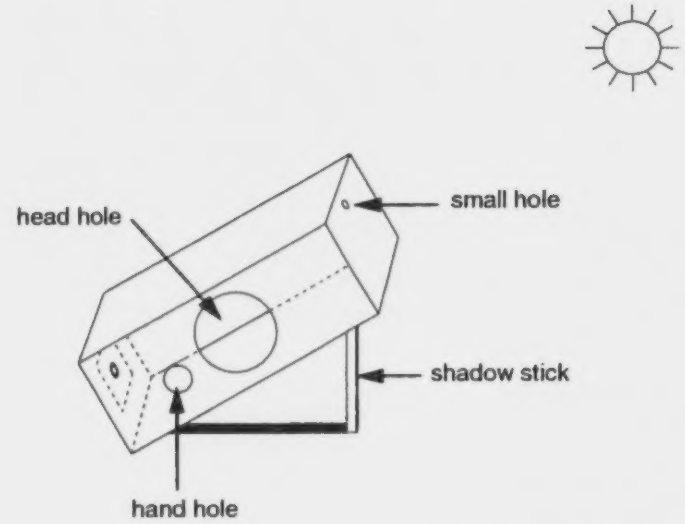

head hole
small hole
shadow stick
hand hole

Figure 3.2.11(1) Camera obscura aligned using a shadow stick.

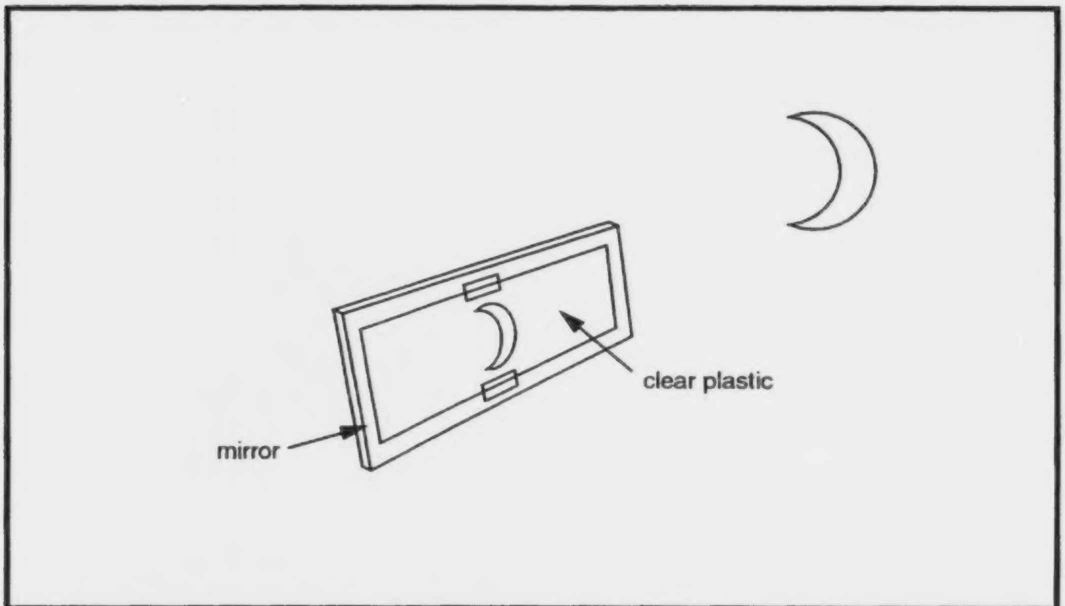

clear plastic
mirror

Figure 3.2.11(2) Using a mirror to trace the image of the moon.

DASH

WEATHER LOGOS
SP 3.2.1A

Name: ______________________

Date: ______________________

WEATHER CONDITION	LOGO	WEATHER CONDITION	LOGO
COLD TEMPERATURE			
MILD TEMPERATURE			
HOT TEMPERATURE			

SP 3.2.1B

DASH

GENERAL WEATHER SP 3.2.1B

Name: ______________________

Date: ______________________

SEASON:

WEATHER TYPE		NO. OF DAYS	WEATHER TYPE		NO. OF DAYS
TEMPERATURE	COLD		CLOUDS	CLEAR	
	MILD			PARTLY COVERED	
	HOT			TOTALLY COVERED	
WIND	NONE		**OTHER**		**NO. OF DAYS**
	SOME		LIGHTNING		
	MUCH		FOG		
PRECIPITATION	RAINY				
	PT. RAINY				
	SNOW				
	PT. SNOW				
	HAIL				

Describe the weather in general for this season.

DASH

TEMPERATURE
SP 3.2.2

Name: ____________________

Date: ____________________

Describe how you found out what temperature feels most comfortable when you are in a room in cold weather.

Describe how you found out what temperature feels most comfortable when you are in a room in hot weather.

Describe how you found out what temperature feels most comfortable when you are exercising or playing a sport.

DASH

BEAUFORT WIND SCALE
SP 3.2.3A

Name: ____________________

Date: ____________________

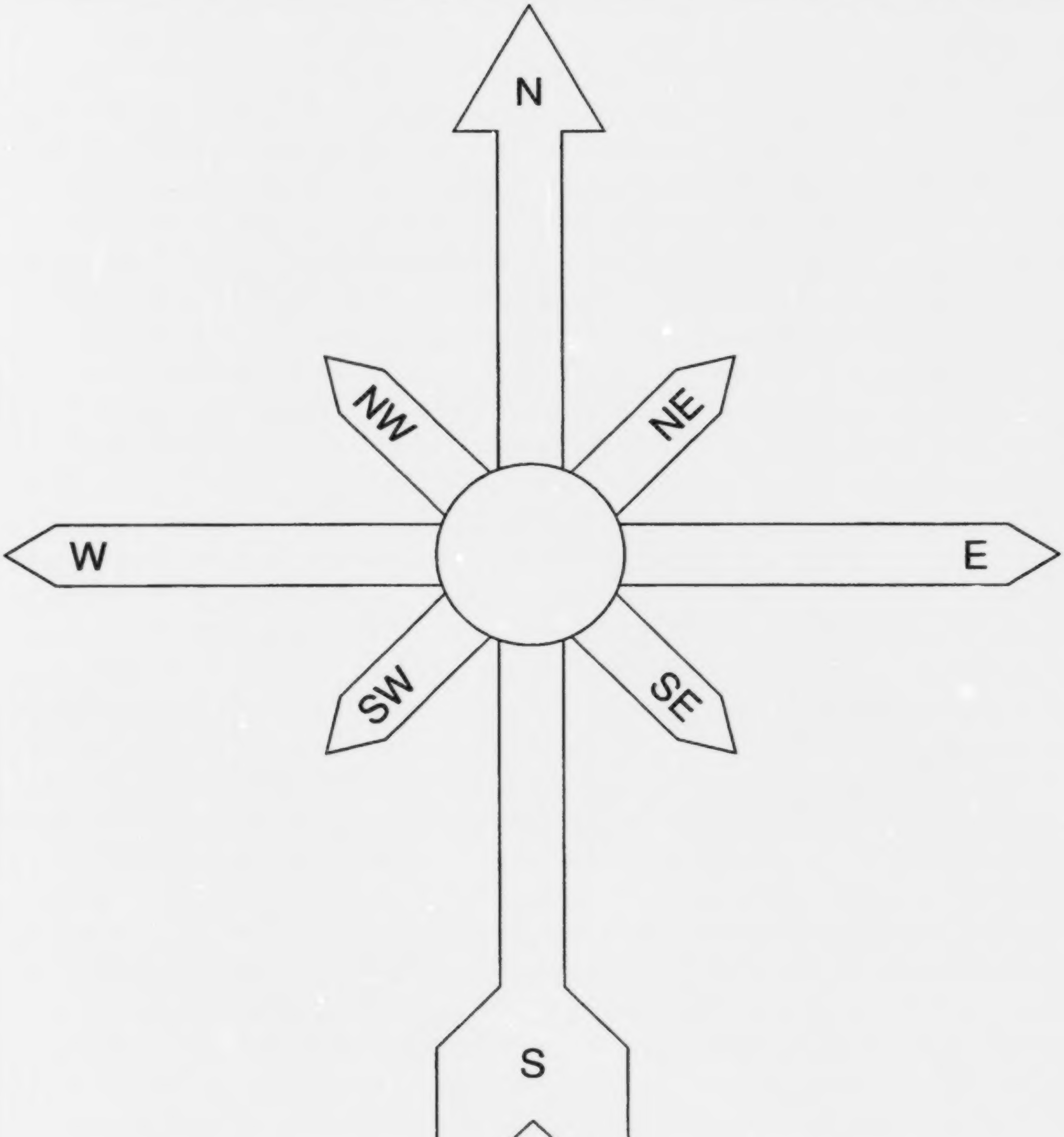
SCALE	MPH	KPH	INDICATORS	KIND	LOGO
0	0–1	0–2	Smoke goes straight up	Calm	
1	2–12	3–20	Smoke drifts sideways, leaves rustle, leaves and twigs in motion	Gentle	
2	13–24	21–40	Small branches move, papers and dust fly, water ripples, small trees sway	Moderate	
3	25–38	41–64	Large branches move, trunks of trees bend, walking is affected	Strong	
4	39–54	65–90	Twigs broken off, shingles carried away	Gale	
5	55–75	92–125	Trees uprooted, widespread damage	Storm	
6	Over 75	Over 125	General disaster	Hurricane Tornado	

DASH

COMPASS ROSE SP 3.2.3B

Name: ____________________

Date: ____________________


N
NW
NE
W
E
SW
SE
S

DASH

WIND SPEED
AND DIRECTION
SP 3.2.3C

Name: ______________________

Date: ______________________

PREVAILING WIND DIRECTION			OTHER OBSERVATIONS
FALL	WINTER	SPRING	

PREVAILING WIND DIRECTION BEFORE A STORM			OTHER OBSERVATIONS
FALL	WINTER	SPRING	

PREVAILING WIND DIRECTION AFTER A STORM			OTHER OBSERVATIONS
FALL	WINTER	SPRING	

DASH

RAIN GAUGE
SP 3.2.4A

Name: ______________________

Date: ______________________

Draw and label a picture of your rain gauge.

Explain how your rain gauge works.

SNOW GAUGE
SP 3.2.4B

Name: ______________________

Date: ______________________

Draw and label a picture of your snow gauge.

Explain how your snow gauge works.

DASH

HUMIDITY
SP 3.2.5

Name: ____________________

Date: ____________________

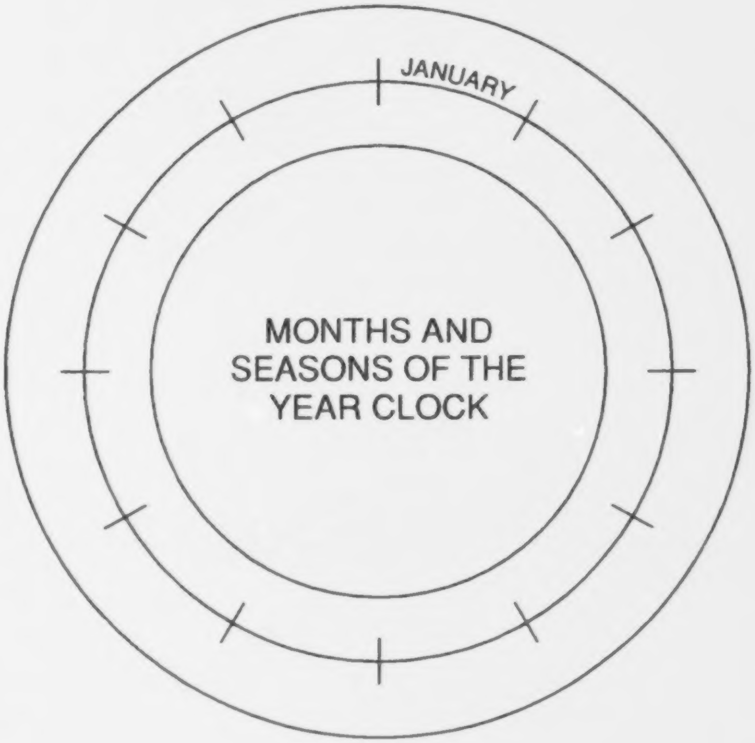
DATE	TEMPERATURE (°C)	HUMIDITY (COLOR)	COMFORT LEVEL (+, -, OK)

PREDICTIONS
SP 3.2.6

Name: ______________________

Date: ______________________

DAY	PREDICTED DATES			OBSERVED DATE
FALL EQUINOX				
WINTER SOLSTICE				
SPRING EQUINOX				
SUMMER SOLSTICE				


JANUARY
MONTHS AND SEASONS OF THE YEAR CLOCK

Label the months. Mark and label the solstices (WS, SS) and equinoxes (FE, SE). Mark and label the seasons on the inner circle.

MOON GRAPH
SP 3.2.7A
Page 1

Name: ______________________

Date: ______________________

GLUE

MONTH:	DATE	PHASE	(2400-0000) 12:00 AM MIDNIGHT	(0100) 1:00 AM	(0200) 2:00 AM	(0300) 3:00 AM	(0400) 4:00 AM	(0500) 5:00 AM	(0600) 6:00 AM	(0700) 7:00 AM	(0800) 8:00 AM	(0900) 9:00 AM	(1000) 10:00 AM	(1100) 11:00 AM	(1200) 12:00 PM

DASH

MOON GRAPH
SP 3.2.7A
Page 2

Name: ______________________

Date: ______________________

GLUE

Directions: You will need 2 copies of SP 3.2.7A–1 and SP 3.2.7A–2 for each month. The numbers in parentheses stand for military or 24-hour time.

GLUE

(1300) 1:00 PM	(1400) 2:00 PM	(1500) 3:00 PM	(1600) 4:00 PM	(1700) 5:00 PM	(1800) 6:00 PM	(1900) 7:00 PM	(2000) 8:00 PM	(2100) 9:00 PM	(2200) 10:00 PM	(2300) 11:00 PM	(2400-0000) 12:00 AM MIDNIGHT

SP 3.2.7B

MOON PREDICTIONS
SP 3.2.7B

Name: ____________________

Date: ____________________

CYCLE	DATES							
	NEW MOON		FIRST QUARTER		FULL		THIRD QUARTER	
	PRED	OBS	PRED	OBS	PRED	OBS	PRED	OBS
1								
2								
3								
4								
5								
6								

How many days between new moons?

Cycle 1 and 2	Cycle 2 and 3	Cycle 3 and 4	Cycle 4 and 5	Cycle 5 and 6

How many days between phases?

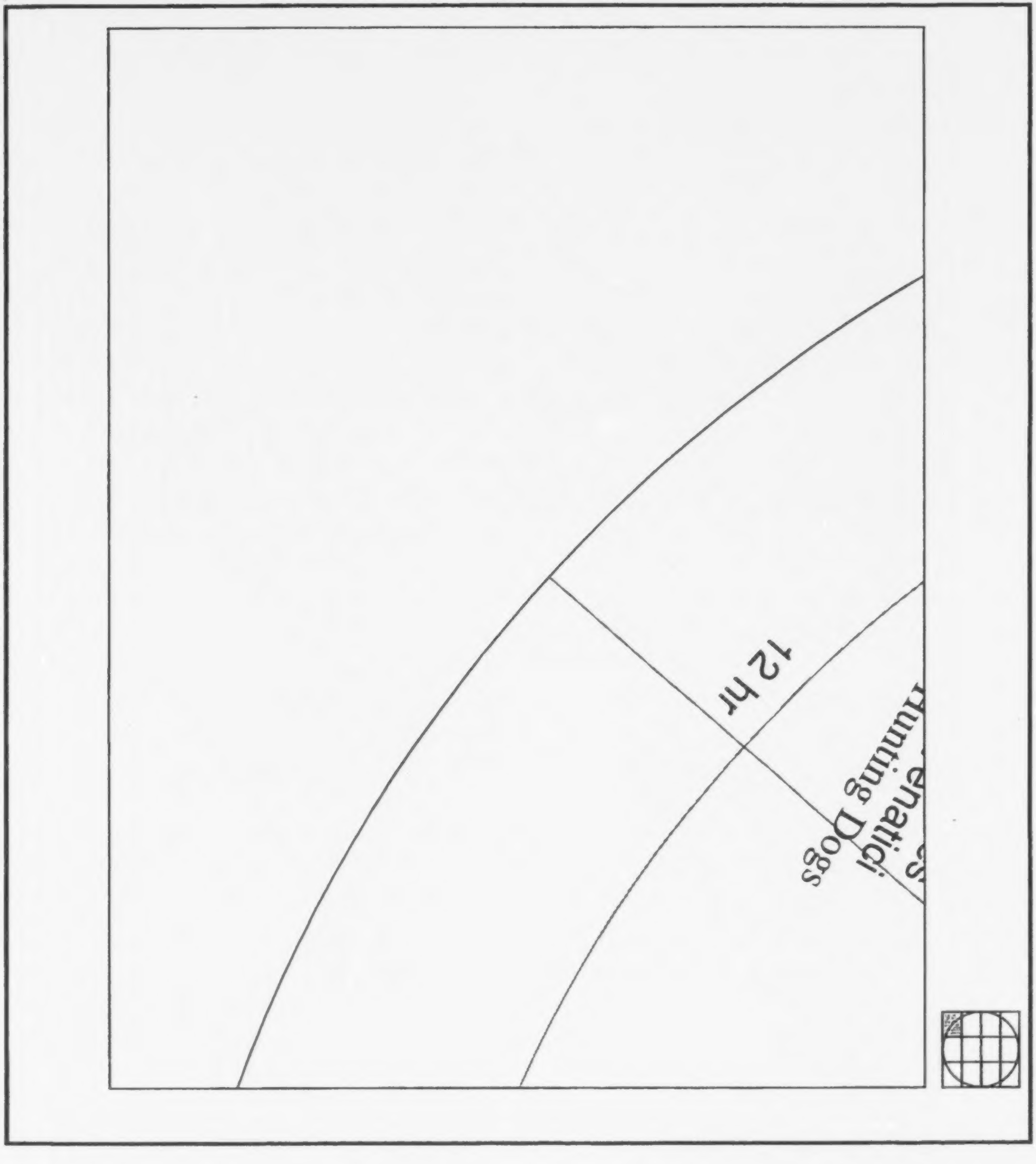
CYCLE	NEW TO 1st Q	1st Q TO FULL	FULL TO 3rd Q	3rd Q TO NEW
1				
2				
3				
4				
5				
6				

DASH

LARGE POLAR SKY MODEL
SP 3.2.8A Page 1

Name: ______________________

Date: ______________________

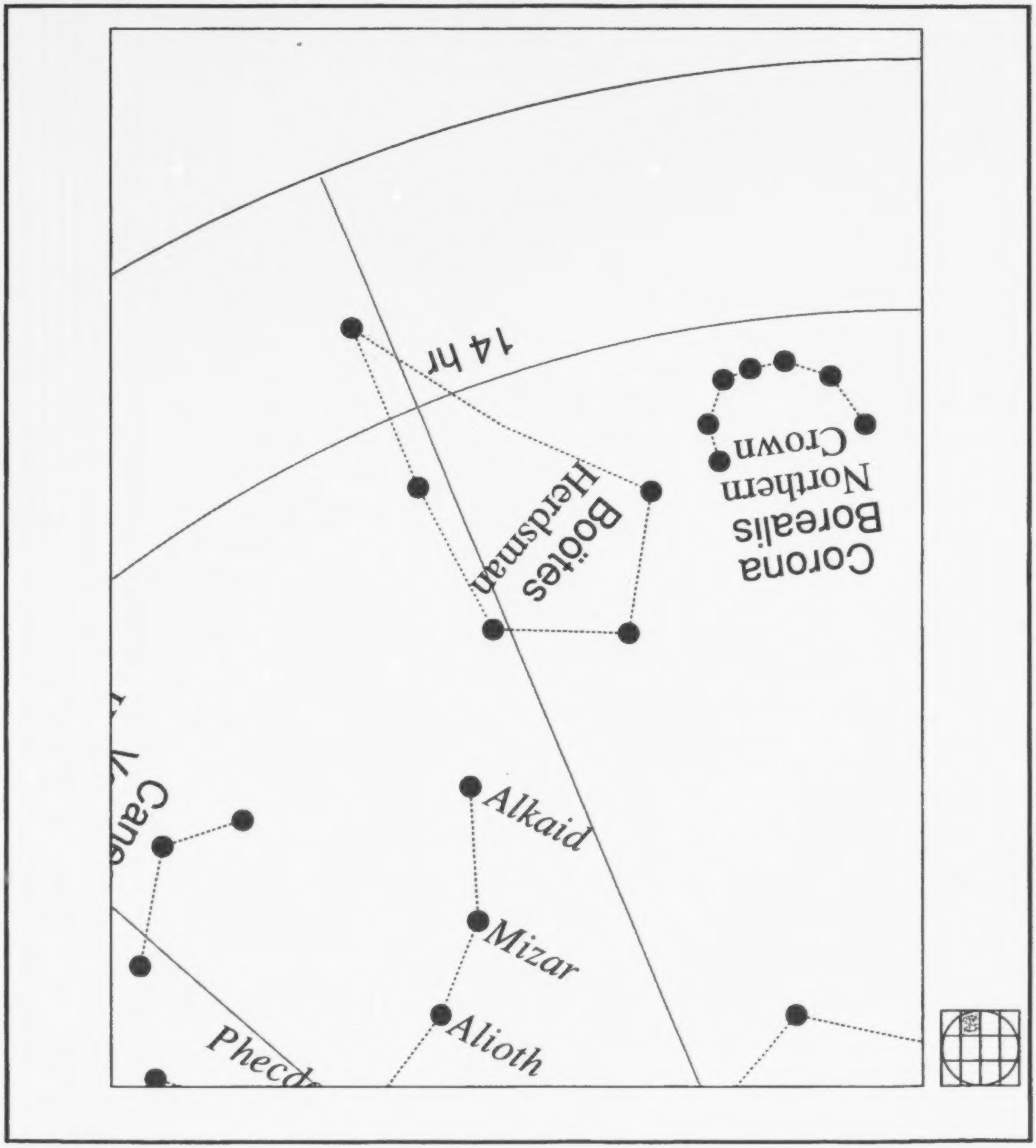

12 hr
Hunting Dogs
enatici
s

DASH

LARGE POLAR SKY MODEL SP 3.2.8A Page 2

Name: ____________________

Date: ____________________

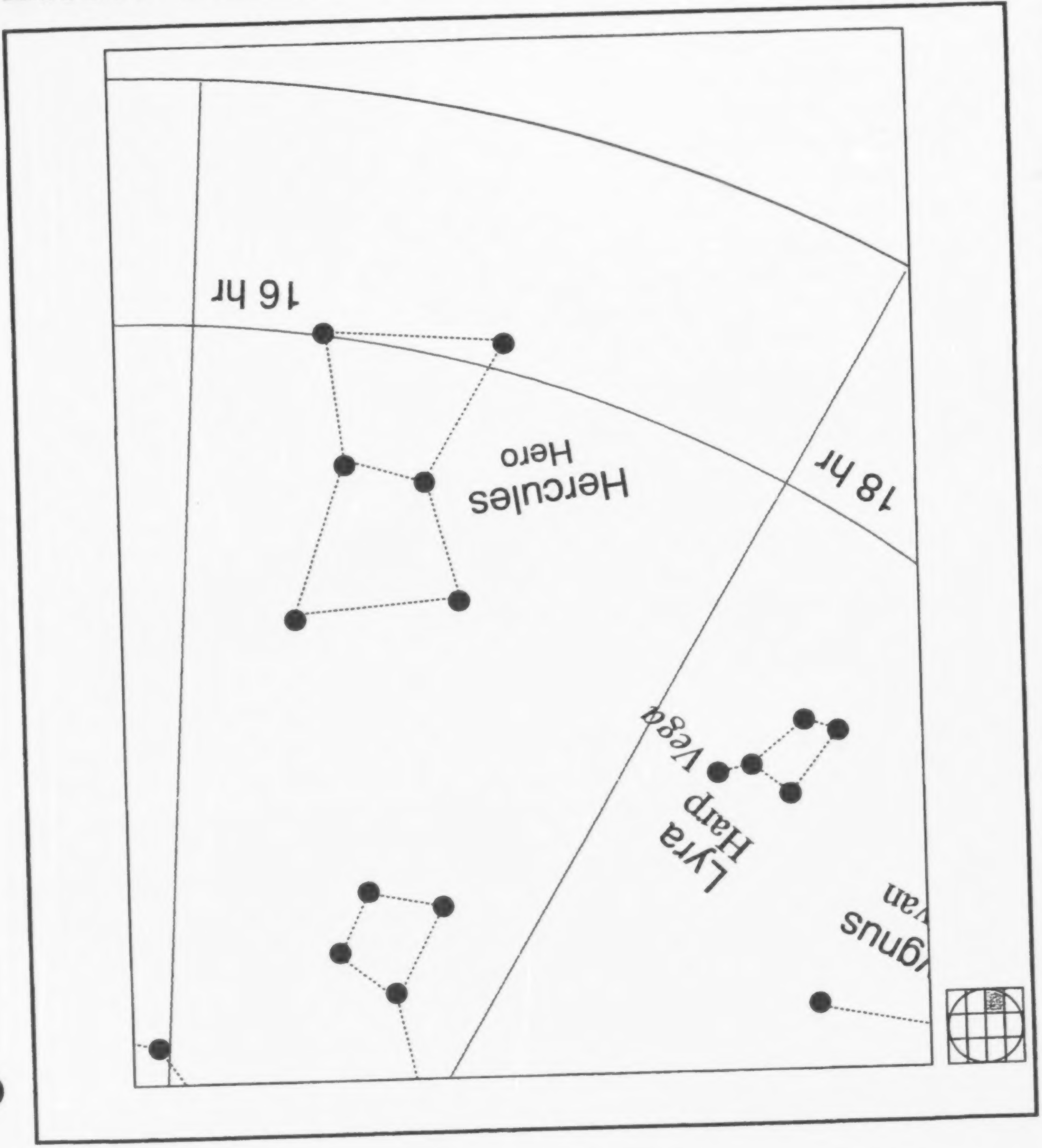

14 hr
Boötes
Herdsman
Corona Borealis
Northern Crown
Cane
Alkaid
Mizar
Alioth
Phecd

DASH

LARGE POLAR SKY MODEL
SP 3.2.8A Page 3

Name: ____________________

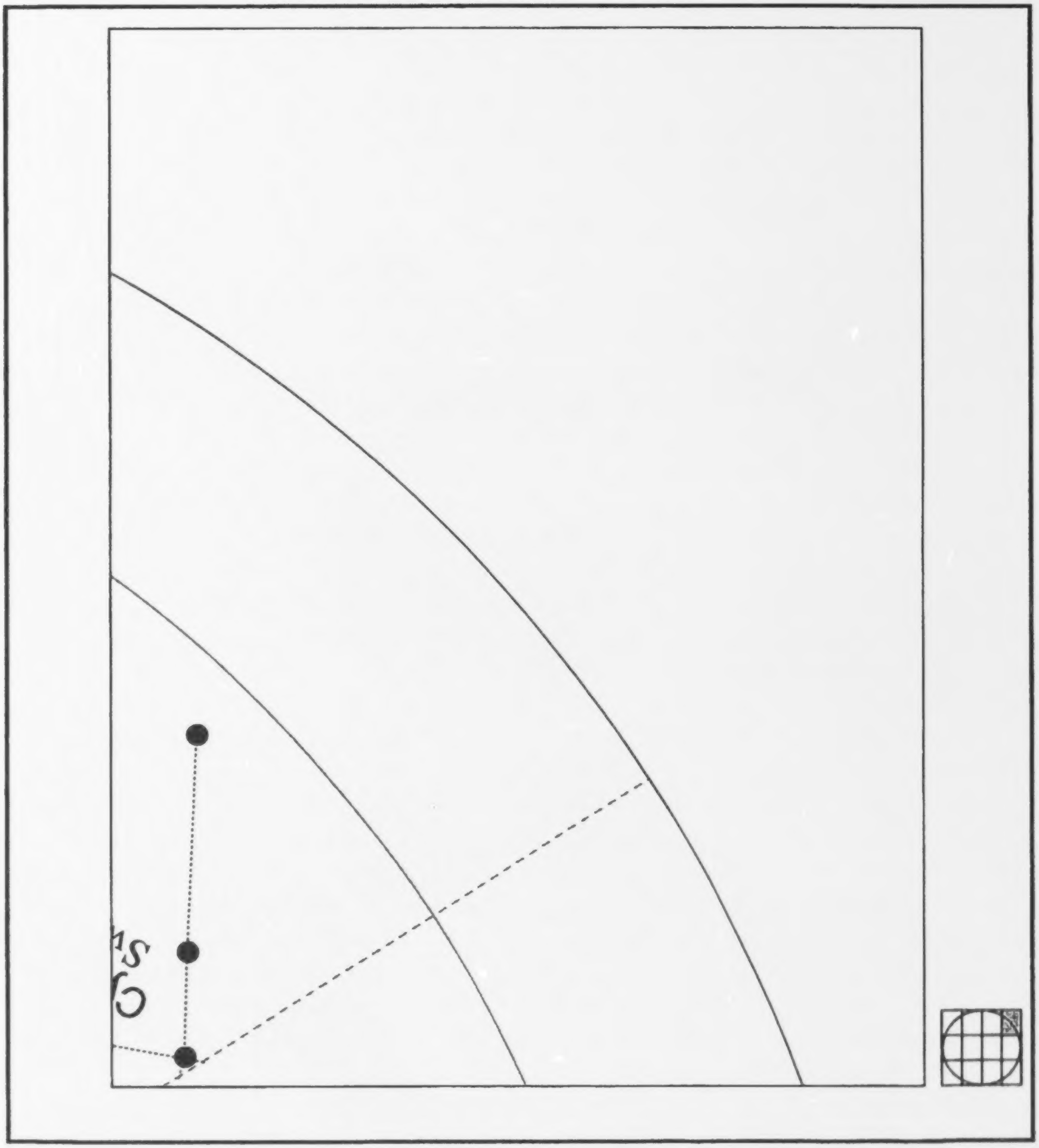
Date: ____________________


16 hr
18 hr
Hercules
Hero
Vega
Lyra
Harp
ygnus
wan

LARGE POLAR SKY MODEL
SP 3.2.8A Page 4

Name: ______________________

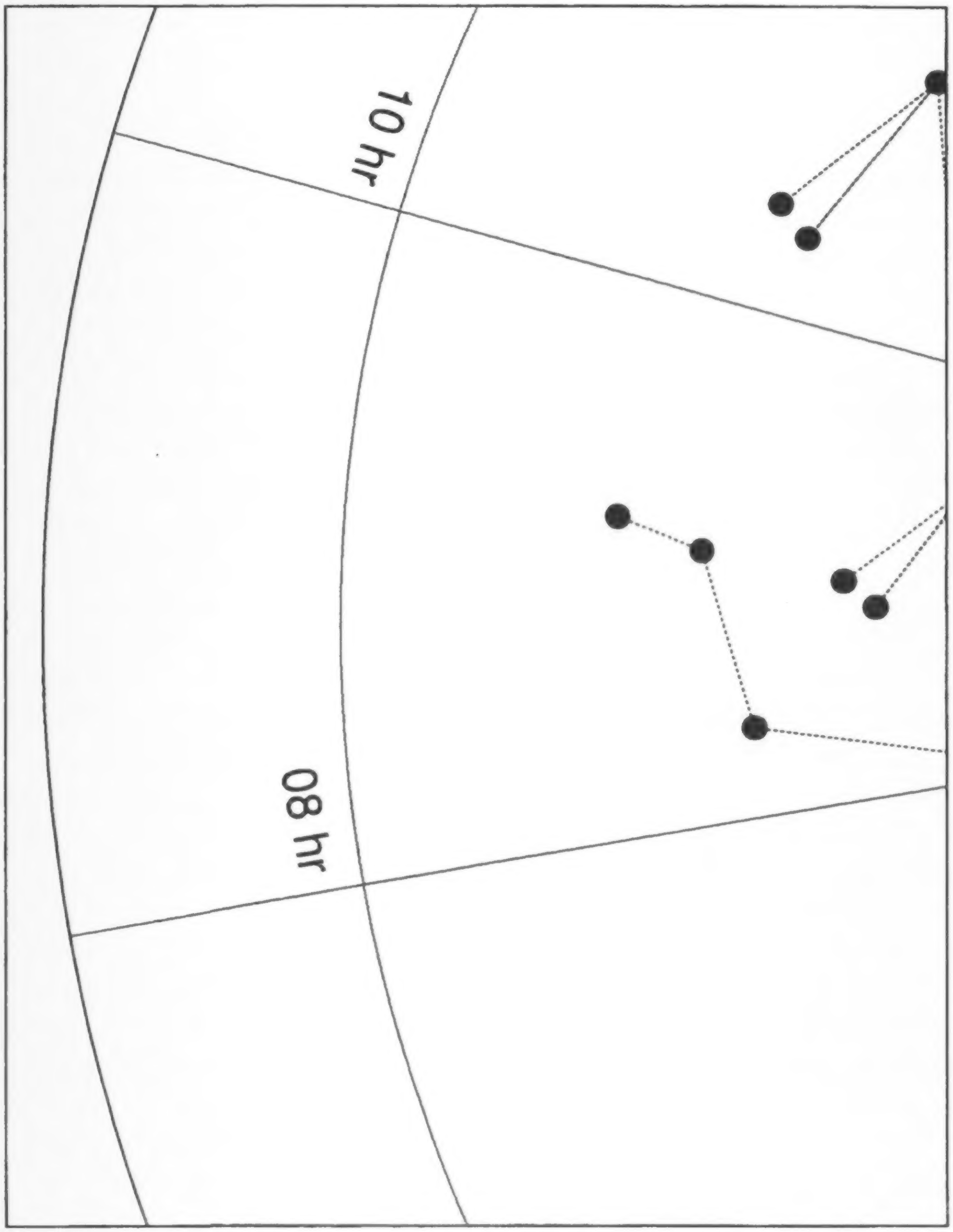
Date: ______________________



LARGE POLAR SKY MODEL SP 3.2.8A Page 5

Name: ______________________

Date: ______________________

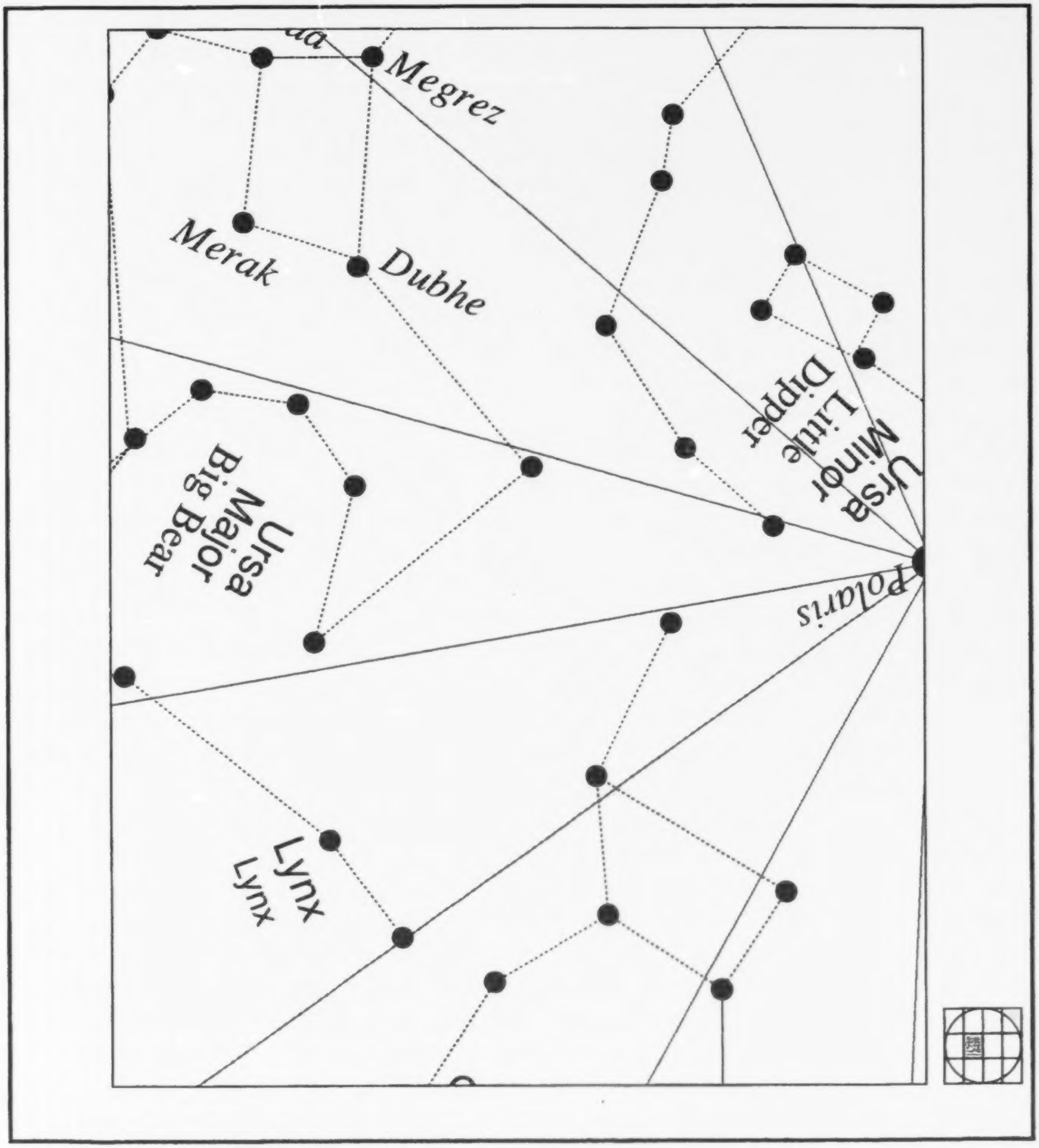


DASH

LARGE POLAR SKY MODEL
SP 3.2.8A Page 6

Name: ______________________

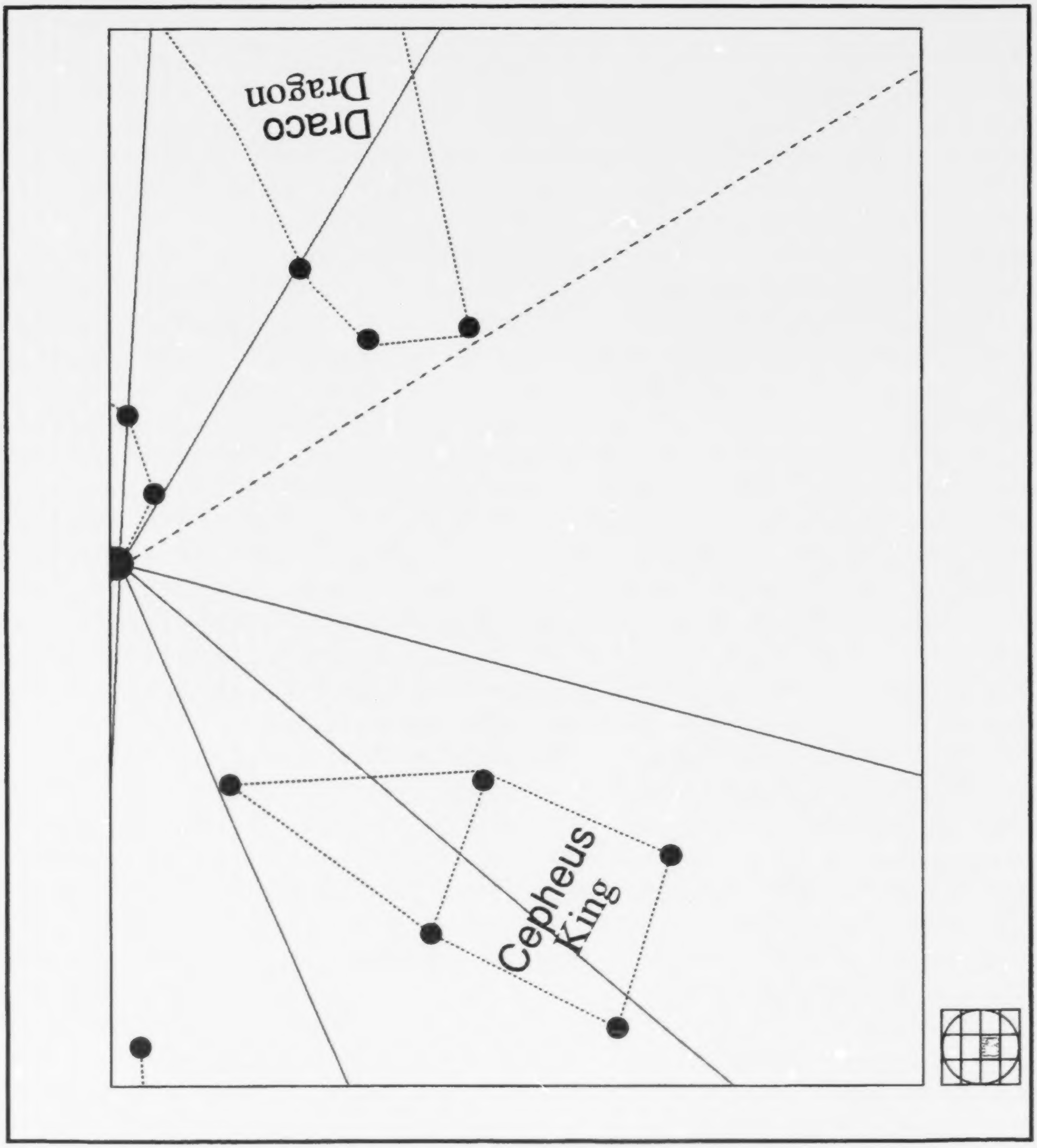
Date: ______________________


da
Megrez
Merak
Dubhe
Ursa Minor
Little Dipper
Ursa Major
Big Bear
Polaris
Lynx
Lynx

LARGE POLAR SKY MODEL
SP 3.2.8A Page 7

Name: ____________________

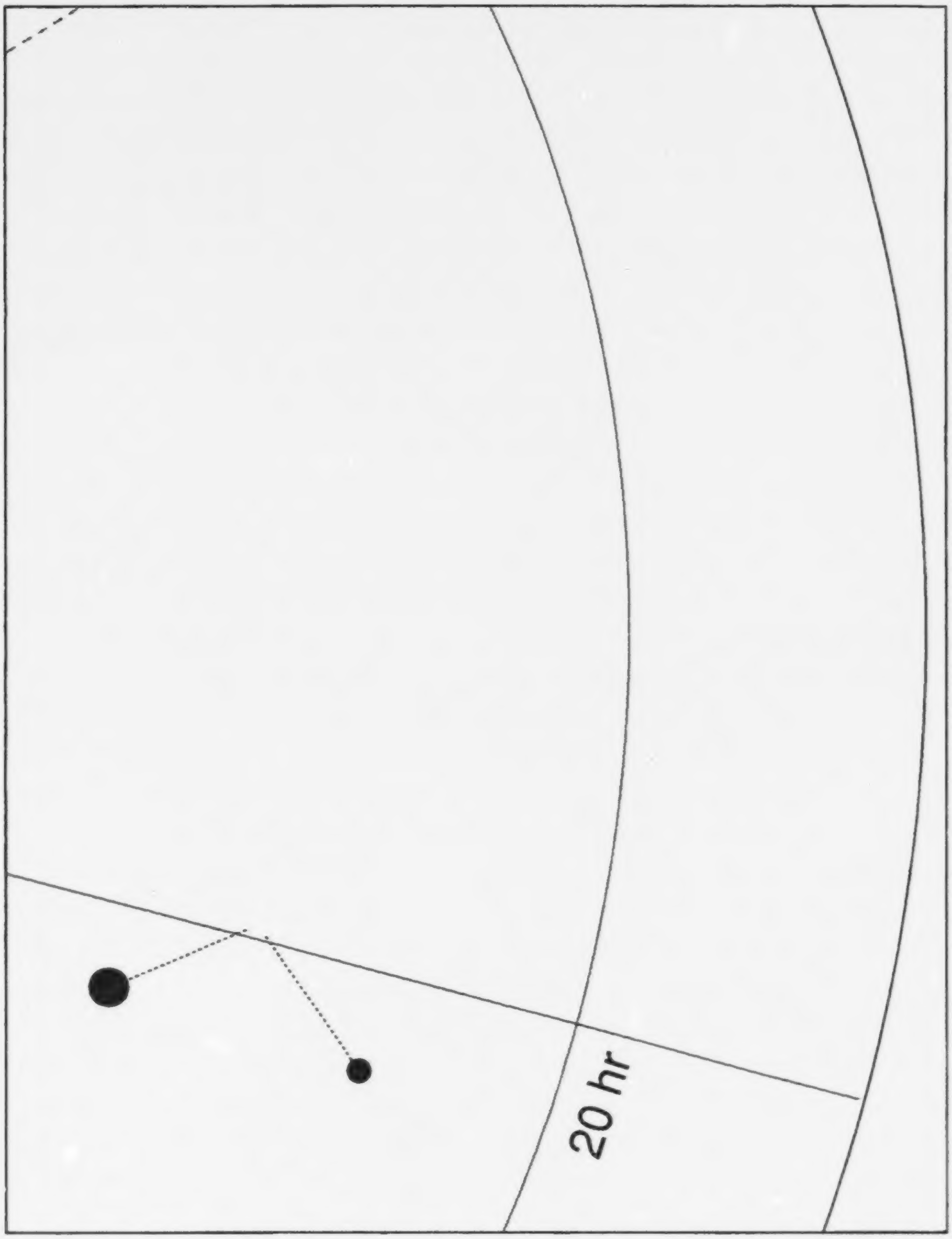
Date: ____________________


Draco
Dragon
Cepheus
King

LARGE POLAR SKY MODEL
SP 3.2.8A Page 8

Name: ______________________

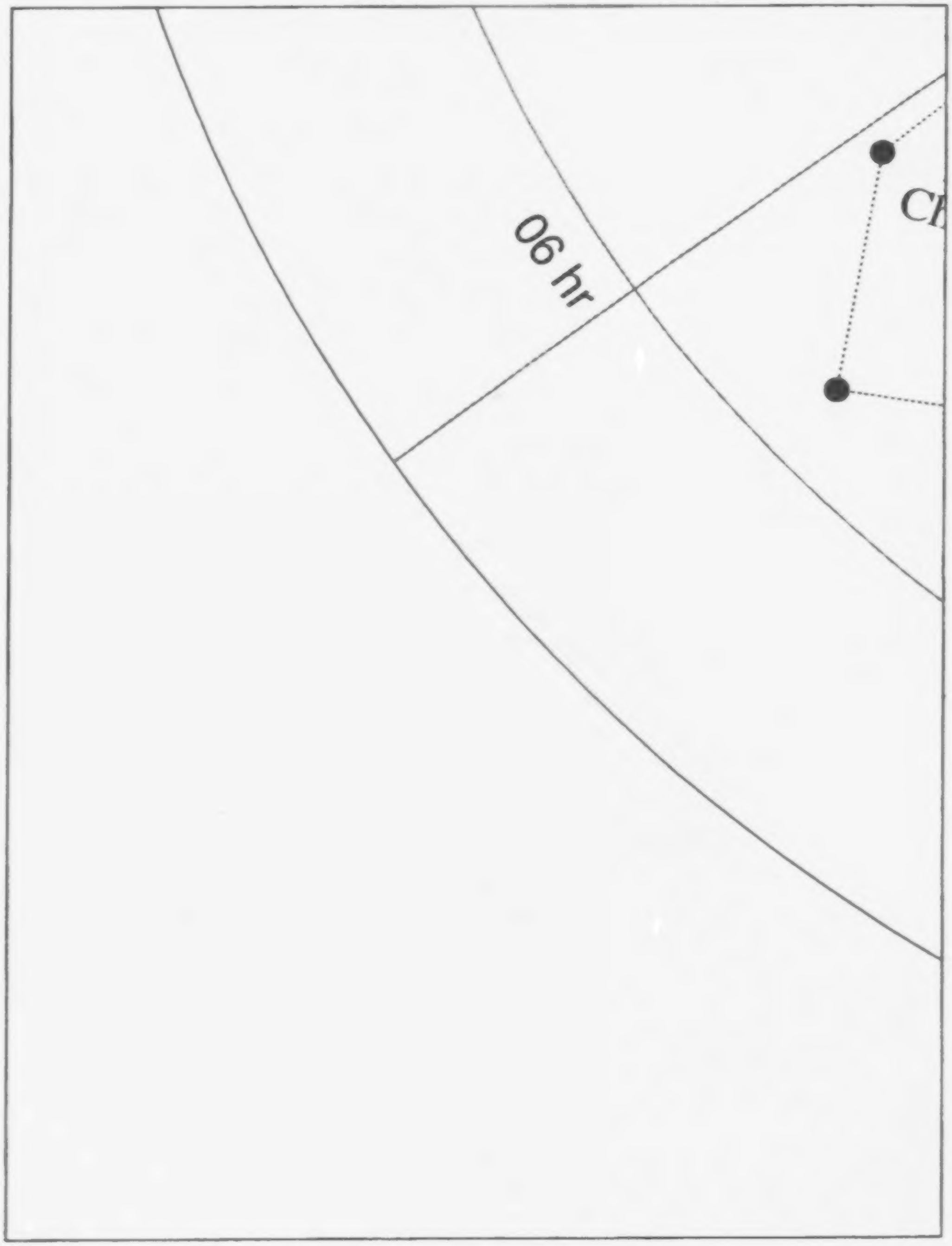
Date: ______________________



LARGE POLAR SKY MODEL SP 3.2.8A Page 9

Name: ______________________

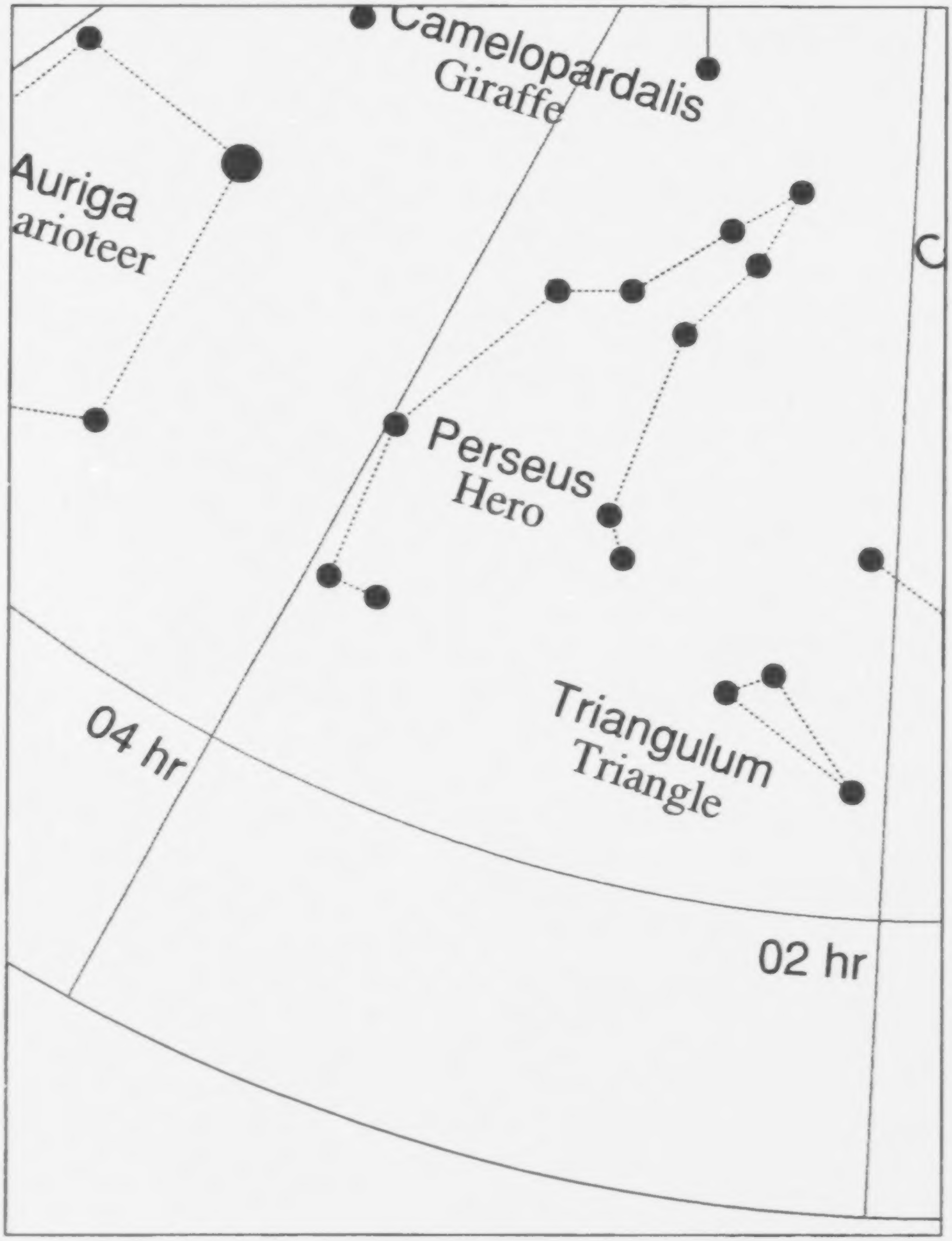
Date: ______________________



LARGE POLAR SKY MODEL SP 3.2.8A Page 10

Name: ______________________

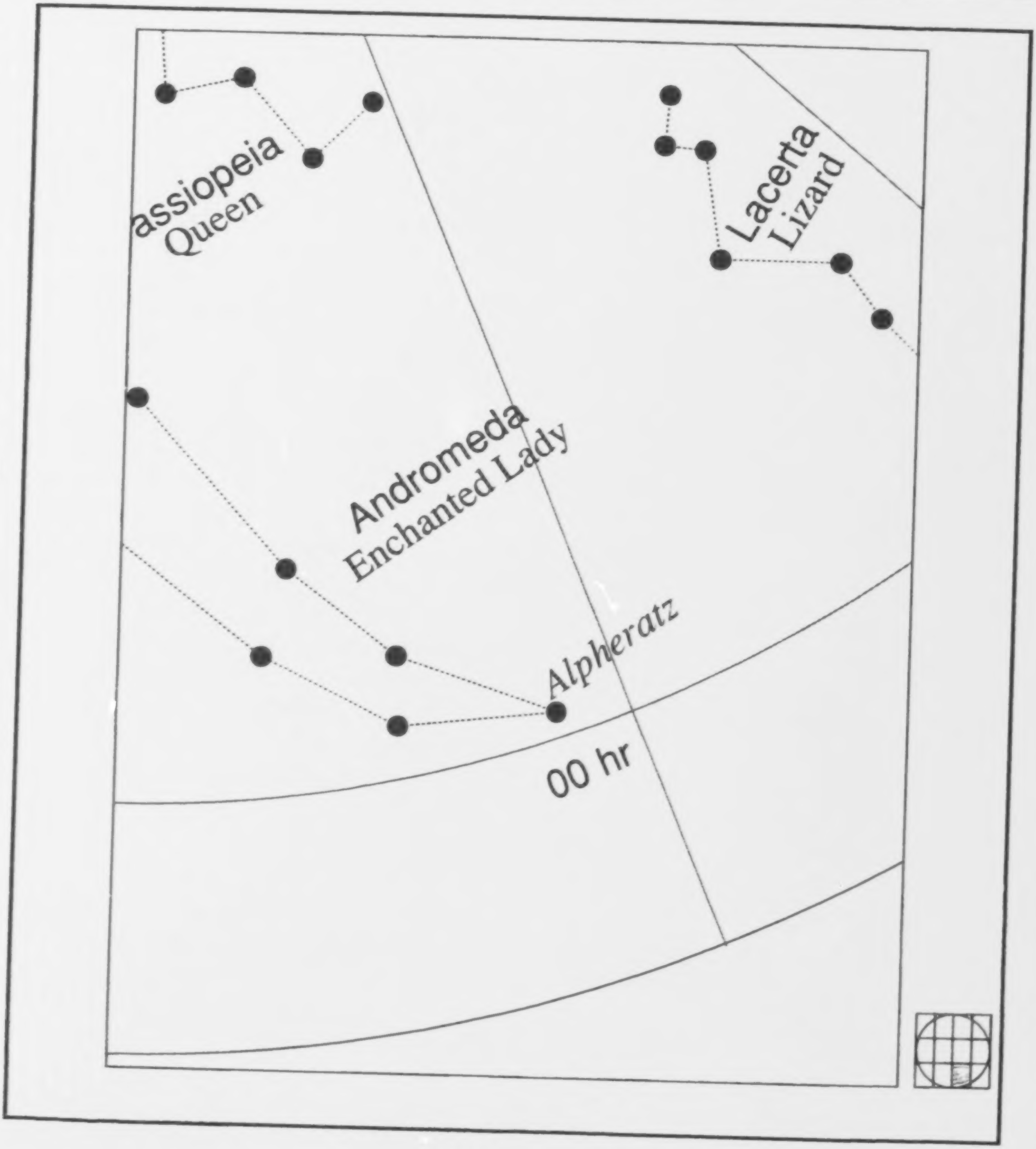
Date: ______________________


Camelopardalis
Giraffe
Auriga
arioteer
Perseus
Hero
Triangulum
Triangle
04 hr
02 hr
C

LARGE POLAR SKY MODEL
SP 3.2.8A Page 11

Name: ______________________

Date: ______________________

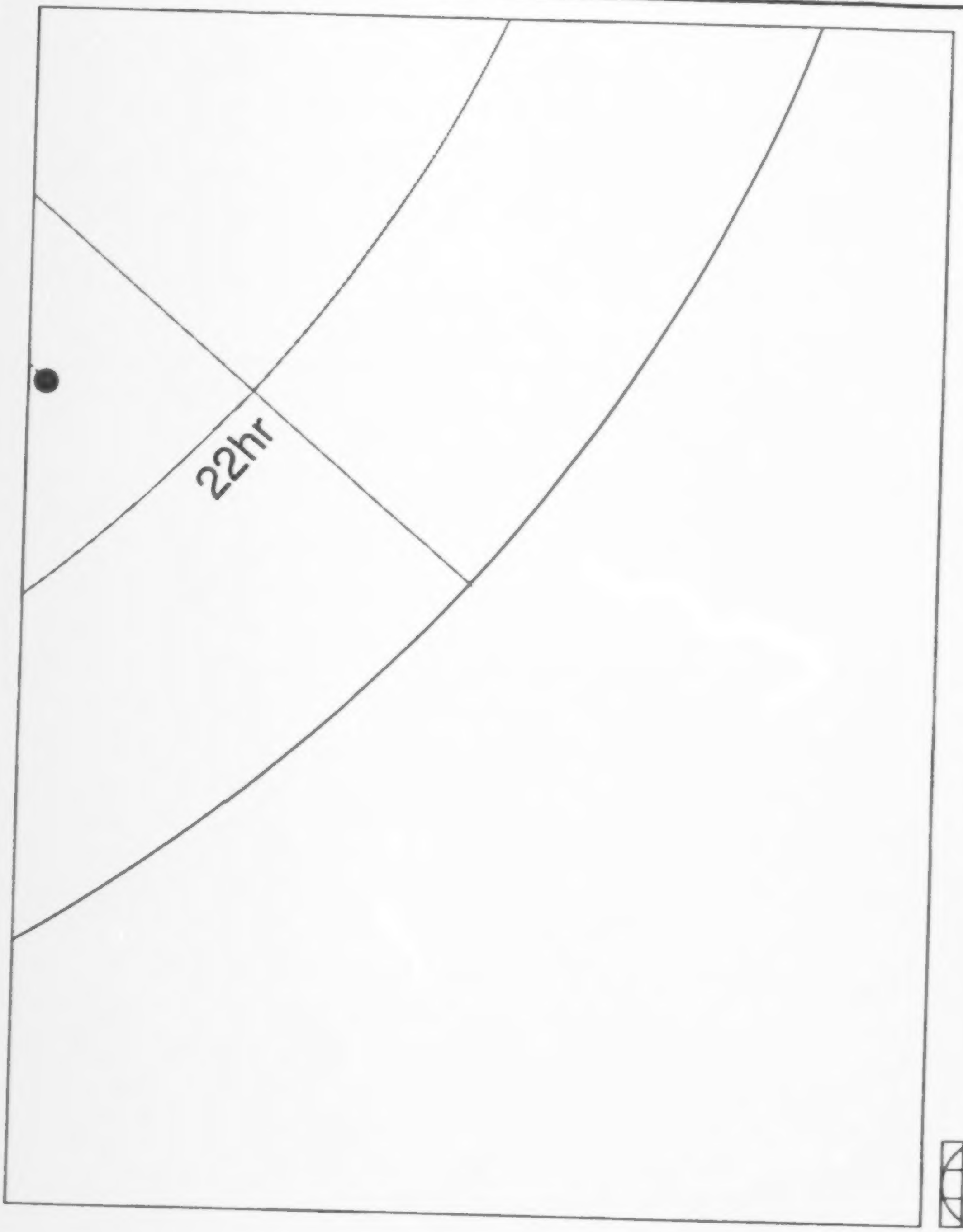

assiopeia
Queen
Lacerta
Lizard
Andromeda
Enchanted Lady
Alpheratz
00 hr

DASH

LARGE POLAR SKY MODEL
SP 3.2.8A Page 12

Name: ______________________

Date: ______________________

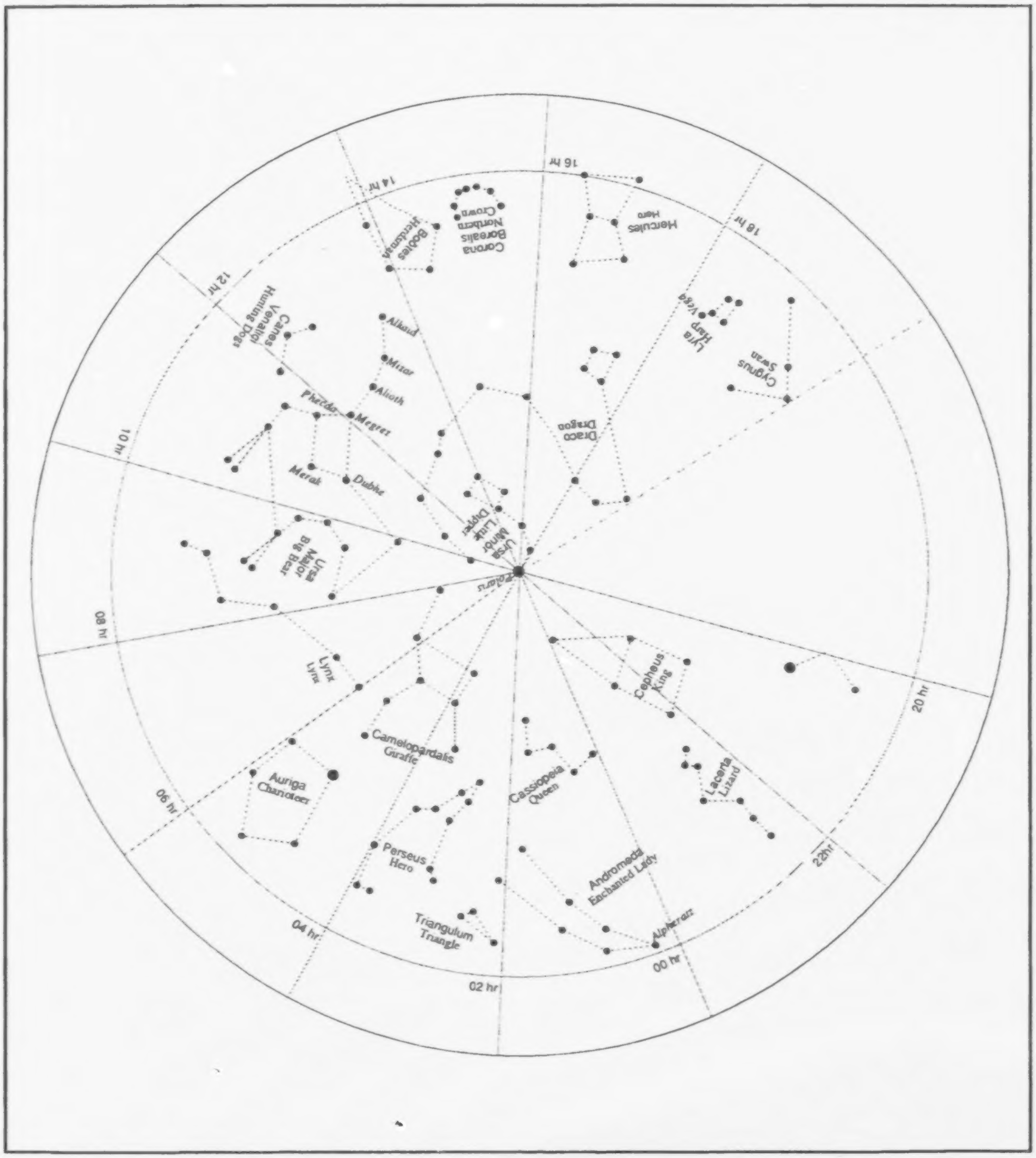


DASH

SMALL POLAR SKY MODEL INSIDE VIEW SP 3.2.8B

Name: ______________________

Date: ______________________


14 hr
16 hr
18 hr
12 hr
10 hr
08 hr
06 hr
04 hr
02 hr
00 hr
22hr
20 hr
Bootes
Herdsman
Corona Borealis
Northern Crown
Hercules
Hero
Lyra
Harp
Vega
Cygnus
Swan
Canes Venatici
Hunting Dogs
Alkaid
Mizar
Alioth
Phecda
Megrez
Merak
Dubhe
Draco
Dragon
Ursa Minor
Little Dipper
Ursa Major
Big Bear
Polaris
Lynx
Lynx
Cepheus
King
Camelopardalis
Giraffe
Auriga
Charioteer
Cassiopeia
Queen
Lacerta
Lizard
Perseus
Hero
Andromeda
Enchanted Lady
Alpheratz
Triangulum
Triangle

BEST COPY AVAILABLE

DASH

POLAR CONSTELLATIONS
SP 3.2.9A

Name: ______________________

Date: ______________________

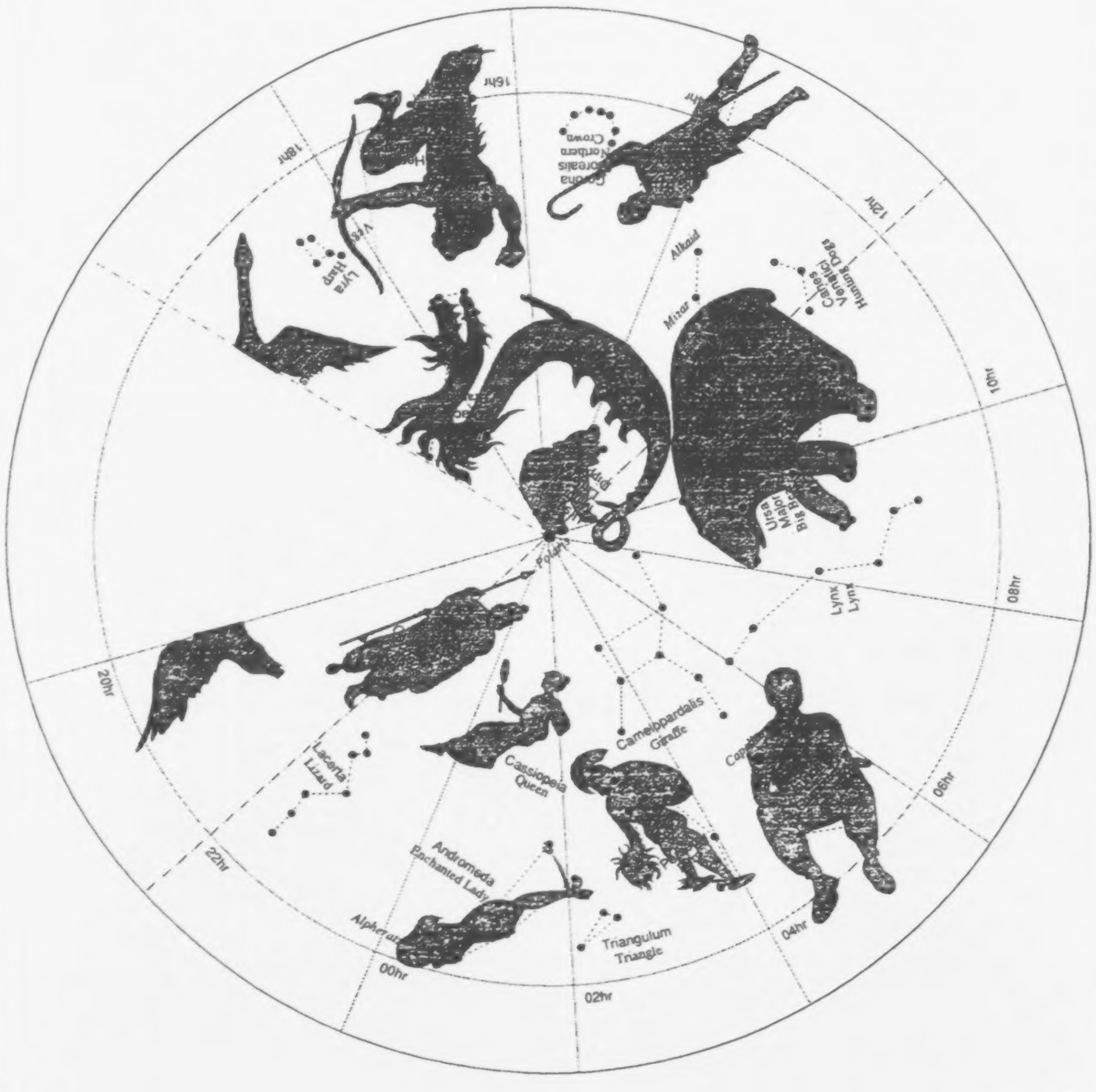
Draw the Big Dipper where you predict it will be located in June, July, and August. Label each drawing with the month. When you make your observation, draw the Big Dipper in another color and label with the date of your observation.

★ North Star

SMALL POLAR SKY MODEL OUTSIDE VIEW SP 3.2.9B

Name: ____________________

Date: ____________________


16hr
18hr
12hr
10hr
08hr
06hr
04hr
02hr
00hr
22hr
20hr
Corona Borealis
Northern Crown
Lyra
Harp
Alkaid
Mizar
Canes Venatici
Hunting Dogs
Ursa Major
Big Bear
Polaris
Lynx
Lynx
Camelopardalis
Giraffe
Cassiopeia
Queen
Lacerta
Lizard
Andromeda
Enchanted Lady
Alpheratz
Triangulum
Triangle

BEST COPY AVAILABLE

DASH

VENUS
SP 3.2.10

Name: ______________________

Date: ______________________

FINDING VENUS			
DATE	TIME	LOCATION	OTHER OBSERVATIONS

DATE:	SUNRISE:	TIME VENUS WAS LAST SEEN:

MEASURING WITH FISTS AND KNUCKLES				
OBJECT	MY FISTS	MY KNUCKLES	AVG. FISTS	AVG. KNUCKLES

MEASURING BETWEEN VENUS AND THE SUN					
DATE	TIME	MY FISTS	MY KNUCKLES	AVG. FISTS	AVG. KNUCKLES

DASH

SOLAR ECLIPSE
SP 3.2.11A

Name: ______________________

Date: ______________________

Draw and label your camera obscura.
Copy or glue your drawings of the solar eclipse. Put the time under each drawing.
Describe or draw and label how you think the sun, the moon, and the earth are positioned at the time of a solar eclipse.

DASH

LUNAR ECLIPSE
SP 3.2.11B

Name: ____________________

Date: ____________________

Draw and label your invention for viewing a lunar eclipse.
Copy or glue your drawings of the lunar eclipse. Put the time under each drawing.
Describe or draw and label how you think the sun, the moon, and the earth are positioned at the time of a lunar eclipse.

DASH

GRADE THREE
CLUSTER 3

ANIMALS

3.3.1 Classroom Pets
3.3.2 Preparing to Raise Insects
3.3.3 Raising Insects
3.3.4 Importance of Insects
3.3.5 Natural Habitats of Frogs and Toads
3.3.6 Making Habitats for Frogs and Toads
3.3.7 Frog Metamorphosis
3.3.8 Importance of Frogs and Toads
3.3.9 Toads and Insects
3.3.10 Hatching Chicks
3.3.11 Chick Growth
3.3.12 Importance of Birds

3.3.1 CLASSROOM PETS

OBJECTIVES

The students
- Take responsibility for the care of classroom pets.

BACKGROUND

Classroom pets are an important component of the DASH program. The students learn to take care of their pet's needs beginning in kindergarten. In the third grade Animal Cluster, they work with insects, chicks, frogs, and toads.

If there are additional classroom pets, use this activity to establish the routine care required to meet the pet's needs.

STUDENT ROLE

Animal caretaker

MATERIALS

chart paper
markers
animals
cages
food
water
newspaper or litter
Student Page 3.3.1 PET CARE

PRODUCTS

Well-cared-for animals
Class chart pet care
Responsibility chart
Completed Student Pages

BEST COPY AVAILABLE

PROCEDURES

1. **Introduce the classroom pet to the students.**

   Have them discuss
   - How to handle the pet.
   - Food and water requirements.
   - Cage maintenance.
   - Other needs of the particular pet.

   Demonstrate the handling and care of the pet as necessary.

2. **Have the students complete Student Page 3.3.1 PET CARE and then make a pet care chart to post near the pet's cage.**

3. **Have the students add pet care jobs to their Responsibility Chart.**

3.3.2 PREPARING TO RAISE INSECTS

OBJECTIVES

The students
- Make a concept map about insects.
- Predict where they can find insect eggs, larvae, and pupae.
- Predict what will emerge at each stage in the development of insects.
- Collect eggs, larvae, and pupae.
- Raise insects to the adult stage of development.
- Identify the different types of insect growth patterns: gradual growth, incomplete metamorphosis, and complete metamorphosis.
- Identify eggs, larvae, caterpillars, pupae, cocoons, chrysalises, and adults.
- Collect the exoskeletons and cases of pupae, chrysalises, and cocoons.

BACKGROUND

This activity is the first of three involving insect study. Many students will have previous experience in finding insect eggs, larvae, and pupae. DASH students will usually have experience in providing habitats for insects to grow and mature. In this activity the students collect eggs if possible, or larvae and pupae, and observe the development through to maturity. They make predictions and then verify them for each stage of insect development. The development is documented in Activity 3.3.3 COMPARING INSECTS. This activity is an ongoing project with insect eggs, larvae, nymphs, and pupae being collected and raised as they are found.

Insect cages can be made from clean milk cartons. The size of the carton is determined by the size of the insect. Observation windows are cut from the sides of the carton. The entire carton is placed inside a piece of nylon stocking. When stretched tightly over the windows this allows for observation and for air to get into the cage for the insects. Water and insect food can be placed in the cage by opening the top. See Figure 3.3.2.

BEST COPY AVAILABLE

Insects have three basic ways of developing from the egg to the adult stage. The first involves **no metamorphosis**. The insect simply grows larger in a series of molts, shedding its old exoskeletons, the hard outer shell, for larger ones. The silverfish matures in this way.

The second way in which insects develop is called **incomplete metamorphosis**. The insect looks like the adult on hatching from the egg but is missing some adult part, usually wings. In its immature state it is called a nymph. After a series of molts that allow the nymph to grow, it gains its adult wings in its final molt. Chinch bugs and grasshoppers have incomplete metamorphoses.

The third way insects develop is called **complete metamorphosis**. The insect emerges as a larva from the egg. This is the caterpillar stage for moths and butterflies. After growing considerably in size, larvae go into the pupae stage. Moths spin a cocoon. Butterflies encase themselves in a plastic-like case called a chrysalis. The adult emerges from the pupae stage. Houseflies and mosquitoes are examples of insects with complete metamorphosis.

STUDENT ROLES

Entomologist
Inventor

MATERIALS

chart paper
markers
milk cartons
plastic containers
plastic wrap
clear plastic scraps
nylons
open-weave cloth
knives, scissors
tape
insect eggs, larvae, pupae, nymphs
Student Page 3.3.2 INSECT OBSERVATIONS

PRODUCTS

Concept map about insects
Class chart on insect growth
Completed Student Pages

PROCEDURES

1. **Have the students make a concept map about insects.**

   Help them include such things as
   - Names of different kinds of insects.
     ✓ Butterflies, moths, beetles, etc.

   - Insect habitats.
     ✓ Where they live.

   - Parts of insects.
     ✓ Head, thorax, abdomen, legs, antennae, eyes etc.

   - Stages of insect development.
     ✓ Egg, larva, pupa, nymph, etc.

   - Ways insects help or harm people.

2. **Discuss with the class the need to understand the roles of insects in the class garden.**

   Explain to the students that to learn more about insects they will
   - Find the eggs, larvae, nymphs, or pupae of insects and raise them to adults.

   - Predict what organisms will emerge from each stage of metamorphosis.

   - Predict and discover the foods the insects eat at each stage.

   - Observe the behavior of the insect during each stage.

3. **Have student groups plan and prepare for the collection, care, observation, and release of insects.**

   Have them
   - Organize their egg, larva, pupa, or nymph hunts.

   - Build observation habitats.

   - Discuss ways to determine what the insect eats at each stage.

   - Plan to collect and mount the molted exoskeletons and pupal, chrysalis, and cocoon cases.

- Decide what is to be observed.
- Make Responsibility Charts for feeding, observing, measuring, and drawing their organisms.

4. Have the students begin their insect raising projects.

Have them
- Collect the insect eggs, larvae, pupae, or nymphs.
- House their specimens in appropriate habitats.
- Care for and feed their insects.
- Record observations on SP 3.3.2 INSECT OBSERVATIONS.
- Begin Activity 3.3.3 RAISING INSECTS.

EXTENSIONS

- Have the students make insect gardens in large containers that hang from the ceiling to save shelf space. Have them invent ways for raising and lowering their insect cages in order to make observations.
- Have student groups make displays showing the various stages in the development of their different insects.

ILLUSTRATION

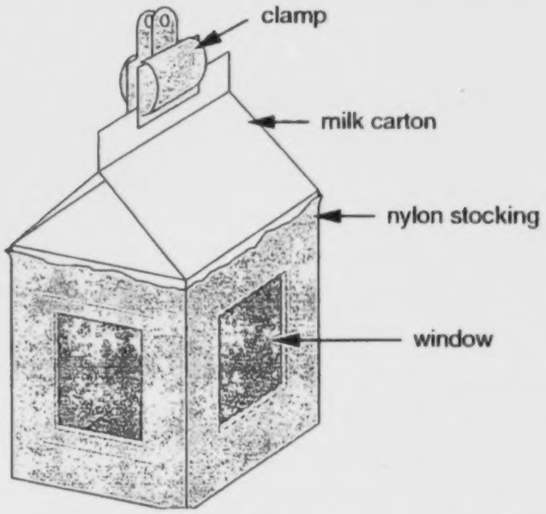

clamp
milk carton
nylon stocking
window

Figure 3.3.2 Insect Cage

3.3.3 RAISING INSECTS

OBJECTIVES

The students
- Observe the development of insects.
- Compare body parts of different larvae.
- Compare the size and shape of different pupae.
- Compare the body parts and shapes of adult insects.

BACKGROUND

This activity follows 3.3.2 PREPARING TO RAISE INSECTS. It is designed to have the students carefully observe insects as they go through each stage in their development. At each stage a series of questions are suggested to encourage the students to extend the study they planned for themselves in Activity 3.3.2. The students' questions should be discussed and added as an insect reaches each stage.

STUDENT ROLE

Entomologist

MATERIALS

insects from Activity 3.3.2 PREPARING TO RAISE INSECTS
chart paper
markers
Student Page 3.3.3 MORE INSECT INVESTIGATIONS

PRODUCTS

Class chart on comparing insects
Completed Student Pages

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PROCEDURES

1. **When immature insects, nymphs or larvae, first emerge from the eggs, have the students discuss and expand on the questions they plan to investigate.**

   Help them include such questions as
   - How much will they grow?
   - How can we find out?
   - What measurements could we make to determine the amount of growth?
     ✔ Help the students include length, mass, and diameter measurements.
   - How much do they eat?
   - What foods do they eat?
   - How long do the insects remain in each stage?
   - How many walking legs do they have?
   - How do they seem to hold onto things when they walk?
   - Can they walk upside down? If so, how?
   - How many body parts do they have?
   - What kinds of parts do they have?
   - What colors and patterns do they have? How might this help them?
     ✔ Help the students explore the possibility of camouflage.
   - Do they have an odor? Is it a pleasant odor? How might this help them?
   - How do they eat? What mouth parts do they have?
   - What kind of droppings do they produce?
   - Do they drink water?
   - If they didn't have a soft body, how could they grow?

- Do all insects become larvae when they hatch from their eggs?

2. **As larvae begin to develop into the pupal stage, have the students again expand their list of questions.**

   Help them include such questions as
   - Where do they go to pupate?
   - What do they do when they pupate?
   - How long does it take to form a pupa case, chrysalis, or cocoon?
   - What size is the case, chrysalis, or cocoon?
   - Does the case, chrysalis, or cocoon change in size while the insect is in it? If so, how?
   - Does the case, chrysalis, or cocoon change in other ways while the insect is in it?
   - How long is the insect in the case, chrysalis, or cocoon?
   - How does the insect get out of the case, chrysalis, or cocoon?
   - How does the shape of the insect change?
   - What stage is the insect in when it emerges from its case, chrysalis, or cocoon?

   Have the students record their selected questions and observations on Student Page 3.3.3 MORE INSECT INVESTIGATIONS.

3. **As nymphs and other immature insects develop into their molting stage, have the students expand their list of questions.**

   Help them include such questions as
   - Where do they go to molt?
   - What do they do when they molt?
   - How long does it take them to shed their exoskeletons?
   - How big are they before and after each molt?

- Do they change in any way while in their exoskeletons?
- How many molts do they go through?
- How long is the time between molts?
- Do they grow between molts?
- Do they undergo color, marking, or pattern changes between molts?
- Is there a color or marking pattern change before and/or after each molt?
- How do the adults differ from the first immature insects emerging from the eggs?
- Are there differences in male and female adults?
- How long before adults lay eggs?
- How are the male and the female insects attracted to each other?
- How long do adults live?

4. **As pupating insects begin to emerge as adults, have the students extend their question lists once more. Then have them release their insects and make their final observations in the wild.**

Help them include such questions as

- How do the insects expand their wings?
- How big are the adults compared to the larvae?
- What body parts do adults have that the larvae did not have?
- Do all insects have the same body parts?
- How are the body parts of different insects different?
- What gives the wings of some insects such bright colors?
- How do moths and butterflies differ?

- What do adult insects eat?
- Do adult insects get bigger as they grow older?
- How can we measure the growth of the insects?
- Are the male and female insects different?
- How long do adult insects live?

Have the students record their selected questions and observations on Student Page 3.3.3 MORE INSECT INVESTIGATIONS.

5. **Have the student groups report on their observations to the class.**

   Record any unanswered questions about insects in the Wonder and Discover Book for further investigation.

6. **Have the students use the information from their observations to create a class chart on comparing insects.**

EXTENSION

- Have the students continue to add to their list of questions to be investigated and the class chart on comparing insects as new insects are collected and observed throughout the year.

3.3.4 IMPORTANCE OF INSECTS

OBJECTIVES

The students
- Research the importance of different kinds of insects.
- Report on the importance of different kinds of insects.
- Create or revise their working definition of insects.

BACKGROUND

This activity precedes 3.3.9 TOADS AND INSECTS, 3.4.10 GARDEN INVADERS, and 3.4.11 CONTROLLING INSECTS. Its purpose is to provide background information for understanding why insects are controlled in the garden and in agriculture generally. Although the emphasis is on garden insects, the students can be encouraged to also do research on disease carriers to connect with Cluster 6, Health and Safety.

The students work in pairs to do research that is shared with the class in a report. A format for reporting is provided on Student Page 3.3.4 INSECT REPORT.

There are several million different species of insects. This diversity makes their study very interesting. In this activity the students begin to develop their skill in the recognition of insects. At this stage the insects are identified by descriptive categories that correspond generally with taxonomic orders. These categories are found in most non-technical guides to insects.

Some insect categories to suggest to the students are ants, aphids, bees, beetles, bugs, butterflies, cockroaches, dragonflies, earwigs, flies, grasshoppers, leafhoppers, lice, mantids, mayflies, moths, scale insects, termites, and wasps. If the students are particularly interested in some other insect or spider, they should be encouraged to pursue their interest. Some suggested references are included under Suggested References at the end of this activity.

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STUDENT ROLES

Researcher
Entomologist
Reporter

MATERIALS

Working Dictionary
Wonder and Discover Book
Connections Book
Reference books
Student Page 3.3.4 INSECT REPORT

PRODUCTS

Insect reports
Working definition for insects
Completed Student Pages

PROCEDURES

1. **Have the class discuss the need to collect information on different insects that are found in gardens and in our environment.**

   Help the students
   - Form research teams.
   - Discuss the contents of the report.
     ✔ See Student Page 3.3.4 INSECT REPORT.
   - Select an insect to report on from the list of suggested insects to research.

2. **Have the student teams research their insects, write up their findings, and report on their insects to the class.**

   Have them add new information to their concept map about insects.

3. **Have the students create or revise their working definition on insects and record it in the Working Dictionary.**

   Record any unanswered questions about birds in the Wonder and Discover Book.

4. **Have the class discuss the reasons for studying insects. Have them record their ideas in the Connections Book.**

   Ask such questions as these:
   - Who else needs to learn about insects?
   - Where else do insects harm or help us besides in our garden?
   - What other uses do insects have?

EXTENSIONS

Have the students
- Make the report session into a TV show.
- Create a bulletin board displaying pictures of each insect and its description.
- Compile insect reports into a class book on insects.
- Make an Insect Card Game that calls for matching pictures of insects with their descriptions.

SUGGESTED REFERENCES

1966 Fichter, George S. and Zim, Herbert S.
Insect Pests. (A Golden Nature Guide) Golden Press: NY.

1977 Orlans, F. Barbara.
Animal Care From Protozoa to Small Mammals. Addison-Wesley Publishing Company: Menlo Park.

1980 DeManche, Sr. Edna and Hapai, Marlene.
Insects. (Hawaii Nature Study Program) CRDG: Honolulu.

1987 Mitchell, Robert T. and Zim, Herbert S.
Butterflies and Moths. (A Golden Nature Guide) Golden Press: NY.

1987 Zim, Herbert S. and Cottam, Clarence.
Insects. (A Golden Nature Guide) Golden Press: NY.

1987 Levi, Herbert W. and Levi, Lorna R.
Spiders and Their Kin. (A Golden Nature Guide) Golden Press: NY

3.3.5 NATURAL HABITATS OF FROGS AND TOADS

OBJECTIVES

The students
- Make a concept map about frogs and toads.
- Observe the habitats of frogs and toads.
- Identify the characteristics of the habitats of frogs and toads.

BACKGROUND

This activity is the first of a series exploring the growth and development of frogs and their value to people. It is followed by Activities 3.3.6 MAKING HABITATS FOR FROGS AND TOADS, 3.3.7 FROG METAMORPHOSIS, 3.3.8 IMPORTANCE OF FROGS AND TOADS, and 3.3.9 TOADS AND INSECTS.

The students report on places where they have seen or heard frogs and toads. Most students from rural and suburban locations will probably have seen and heard frogs in ponds or in slow-moving streams. They may have seen toads in gardens, under boards or rocks, or near marshy areas. A field trip or a film or videotape may be necessary to give urban students a sense of frog and toad habitats.

STUDENT ROLES

Ecologist
Zoologist

MATERIALS

chart paper
markers
Student Page 3.3.5 HABITATS OF FROGS AND TOADS

PRODUCTS

Concept map on frogs and toads
Class list on characteristics of frog and toad habitats
Completed Student Pages

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PROCEDURES

1. **Have the students make a concept map about frogs and toads.**

   Help the students include such things as
   - What frogs and toads do.
   - What frogs and toads look like.
   - Where frogs and toads are found.

2. **Give the students a home project assignment to find out where frogs and toads are found and what those places look like. Have the students discuss how they can find out this information.**

   Help them include such ideas as
   - Going out and looking at places they know about.
   - Asking other people where frogs and toads are found and then finding such a place to see what it is like.
   - Reading about frogs and toads and then looking for a place where they can be found.

3. **Have the students report on their findings. Make a class list of the characteristics of frog and toad habitats.**

EXTENSIONS

Have the students
- Photograph places where they find frogs and toads. Display the photographs.
- Create a mural of frog and toad habitats.

3.3.6 MAKING HABITATS FOR FROGS AND TOADS

OBJECTIVES

The students
- Build a classroom habitat for raising frogs and/or toads from eggs.

BACKGROUND

This activity is the second in the series exploring the growth and development of frogs and toads. The students build a habitat for the raising of frogs and toads from eggs to adults. The characteristics of a suitable habitat were listed on a class list in Activity 3.3.5 NATURAL HABITATS OF FROGS AND TOADS.

Toads usually lay their eggs in water just as frogs do, and they go through similar development and metamorphosis. The characteristics of a frog environment will adequately provide for the needs of both toads and frogs. Such a habitat should include algae-filled water, water plants such as elodea or duck weed, and floating logs or wood for the frogs or toads to crawl on. To get adequate growth of algae, the tank needs to be inoculated with pond water that has algae and be allowed to stand for a week or more preferably in the sunlight before adding the frogs or toads. If there is no aquarium available, a sturdy cardboard box, reinforced with duct tape and lined with heavy-duty clear plastic, can be used. Cut four- or five-inch portholes in the sides of the box for viewing. The outside of the box should be completely wrapped in the plastic.

STUDENT ROLES

Ecologist
Zoologist

MATERIALS

a 25-gallon or larger aquarium
pond mud
water plants such as elodea and duck weed
pond water

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small logs or blocks of wood
Student Page 3.3.6 MAKING FROG AND TOAD HABITATS

PRODUCTS

Frog and toad habitats
Completed Student Pages

PROCEDURES

1. **Have the students use their list of characteristics of frog and toad environments from Activity 3.3.5 NATURAL HABITATS OF FROGS AND TOADS to discuss how they can simulate that environment in an aquarium.**

   Help them include the need for
   - Water plants.
   - Green, algae-filled pond water.
   - Floating objects.

2. **Have the class assemble the habitat. Suggest that the water should stand for at least a week to allow it to become green with algae.**

EXTENSION

- Add other small organisms to the habitat as suggested by the students. These might include small mosquito fish and snails.

3.3.7 FROG METAMORPHOSIS

OBJECTIVES

The students
- Collect frog and/or toad eggs.
- Observe and record the development of the eggs into tadpoles.
- Observe and record the metamorphosis of tadpoles into adult frogs or toads.
- Release the frogs and/or toads into their natural environment.

BACKGROUND

This activity follows Activity 3.3.6 MAKING HABITATS FOR FROGS AND TOADS. Student teams of two to four students collect frog and/or toad eggs and place them in the habitat that they constructed. They observe and record the development of the eggs, the metamorphosis of tadpoles, and the release of the adults into their natural environment.

In most parts of the United States, frogs and toads deposit their eggs in spring. Frogs and toads are quite vocal in the evening during their reproductive cycle. Eggs are found close to the surface of the water near the shore and are usually attached to grass or reeds. Toad egg masses are deposited in long strings while those of frogs are in shapeless globs. The number of eggs in a mass will vary with the species. Individual eggs are surrounded by a gelatinous, transparent sphere that swells in the water.

Have the students go on a field trip to a pond to collect eggs. If this is not possible, there are several alternatives. Have the students bring in eggs. If this is done, it is advisable to send a letter home asking for adult help with the collection. Older students who have done this collecting before may be called on to assist in this activity. Ask for help from your DASH training institution, contact a high school or university biology teacher, or the local Sierra Club. In some urban areas it may be necessary to purchase the eggs from a biological supply house.

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The eggs can be brought to school in a jar with air holes in the lid. The jar should be kept at 60°–80° F or 15°–25° C. On a field trip keep the jar in the shade in a bucket of pond water.

Individual eggs can be separated from the larger mass and observed in a jar lid. Leave the white seal in the lid to provide a good background. The eggs should be covered with water at all times. Have the students use a hand lens to make observations.

After observation single eggs can be kept in small bottles with holes in the lid to allow water to pass in and out. A small piece of water plant should be added to the bottle. Label the bottles for retrieval and keep them on the bottom of the habitat. See Figure 3.3.7(1).

Depending on the frog or toad species and water conditions, the developing tadpole will remain in the gelatinous covering for 8–20 days. The tadpoles may emerge sooner than eight days since it will not be known when the egg mass was laid. In the early stage, the gelatin-covered eggs will be spherical with a light-colored bottom side and dark-colored top. In a few days, the shape will become more like a tadpole.

Tadpoles wiggle out of their gelatinous covering and attach themselves to the remaining egg mass or to plants. Within several days the tadpoles become free swimming and begin to feed on pond scum. All tadpoles should be allowed to swim freely. For closer observation single tadpoles can be put in large jars that have the same habitat features of the larger class habitat. Tadpoles are herbivorous and live on algae. Adequate algae can be maintained by periodically exchanging the water in the jars with water from the class habitat. Tadpoles can be captured with a small net and observed in a jar lid in the same way the eggs were observed. Metamorphosis of the tadpole through the adult stage takes two to three months for most species of toads and frogs. However, bullfrogs take up to two years to go through the tadpole stages.

The length of a tadpole can be measured by placing grid paper under a clear petri dish or any clear plastic container and observing the length against this background. See Figure 3.3.7(2). The volume of a tadpole can be measured by displacement. Have the students make a small graduated container with vertical sides. See Activity 3.10.12 MEASURING DEVICES. Fill the container half full, add the tadpole, and determine how much the volume of water and tadpole increases. The difference between the two volumes is the volume of the tadpole. See Figure 3.3.7(3). The mass of a tadpole can be measured on student-made balances. First measure the mass of the water alone. Then measure the mass of the tadpole and the water. The difference between the two masses is the mass of the tadpole. See Activity 3.10.12 MEASURING DEVICES.

It is suggested that the frogs and tadpoles be released into their natural environment soon after they reach the final adult stage of metamorphosis. Toads can be released into the garden where they help with insect control. See Activity 3.3.9 TOADS AND INSECTS.

STUDENT ROLES

Zoologist
Inventor

MATERIALS

graduated container (See Activity 3.10.12 MEASURING DEVICES)
balance (See Activity 3.10.12 MEASURING DEVICES)
class habitat from Activity 3.3.6 MAKING HABITATS FOR FROGS AND TOADS
hammer
nails
string
index cards
waterproof pen
jars
jar lids
small bottles
wire and open-weave cloth or recycled stockings for nets
grid paper
shallow clear plastic containers or glass containers
hand lenses
frog and/or toad eggs
Student Page 3.3.7 FROGS AND TOADS

PRODUCTS

Nets
Observation systems
Microhabitats
Completed Student Pages

PROCEDURES

1. **Have the students plan and prepare to observe the development and metamorphosis of frogs and toads.**

   Help them include such things as
   - How to obtain the eggs.
     ✔ This decision will require consultation with the teacher. Organization may be extensive if eggs are to be collected on a field trip.

   - How the eggs are to be transported to the school.

   - Responsibility Charts and observation schedules.
     ✔ The first few observations should be done by all students.

   - Invention and construction of microhabitats and observation systems.

2. **Have student teams put the eggs into the class habitat and their microhabitats and begin making observations. See Figure 3.3.7(1). Have them use Student Page 3.3.7 FROGS AND TOADS to record their observations.**

   After the first observation ask such questions as
   - How large is the jelly capsule?

   - How did you measure it?

   - Has the capsule changed in size? If so, how?

   - How big is the egg?

   - How did you measure it?

   - Has the egg changed in size?

   - What does the egg look like?

   - How has the egg changed?

   - How does the tadpole get out of the gelatinous covering?

   - Where do the tadpoles go when they get out of the gelatinous covering?

3. **When the tadpoles are free swimming, have the students transfer them to larger jars and invent and make small nets to capture the tadpoles for further observation.**

4. **Have the students invent a way to determine the length, volume, and mass of a tadpole.**

5. **Have student teams carry out their observations and measurement plans for the developing tadpoles.**

6. **When the tadpoles reach the adult stage, have the students make plans for further observations that can be done in the class habitat or in the natural environment.**

7. **Have the student teams give their reports. Then have the class summarize their observations of the tadpoles.**

   Ask such questions as these:
   - What are the things that happened in the development and metamorphosis of all the frogs and toads?
   - What things were different in our observations of frogs and toads?
   - Why did the teams try to make measurements and close observations of the same egg or tadpole each time?
   - How are frogs and toads similar to insects in their development?
   - How are frogs and toads different from insects in their development?

EXTENSION

- Have the students make class books on the metamorphoses of different species of frogs and toads.

ILLUSTRATIONS

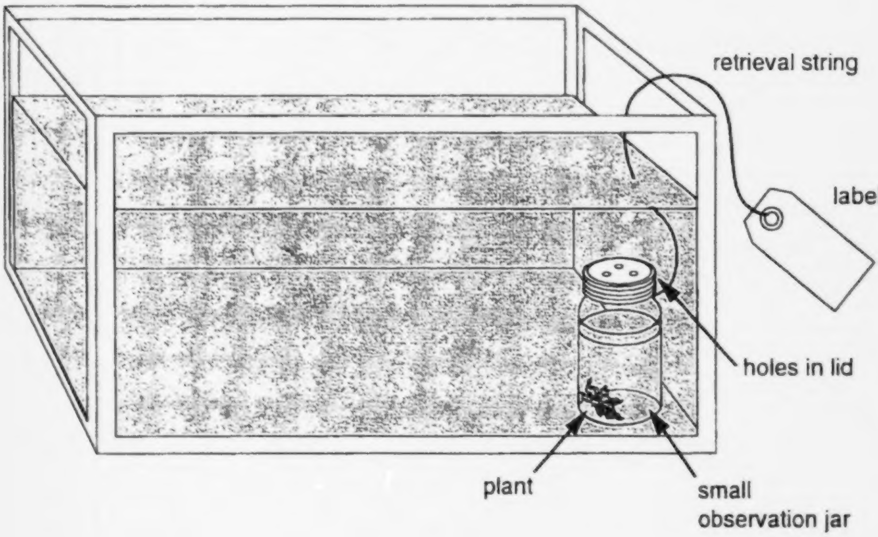
retrieval string
label
holes in lid
plant
small
observation jar

Figure 3.3.7(1) Microhabitat

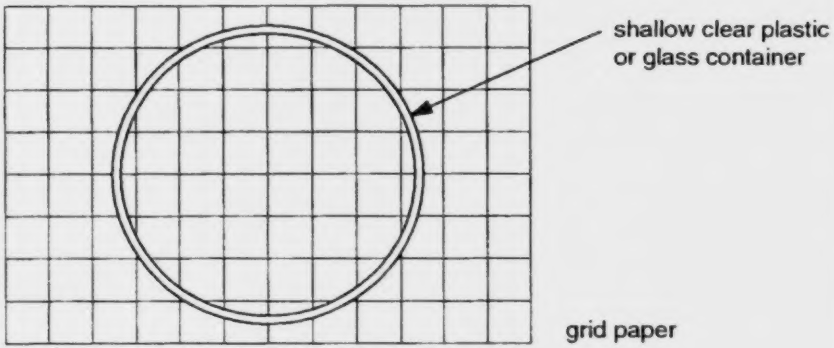
shallow clear plastic or glass container
grid paper

Figure 3.3.7(2) Observation System

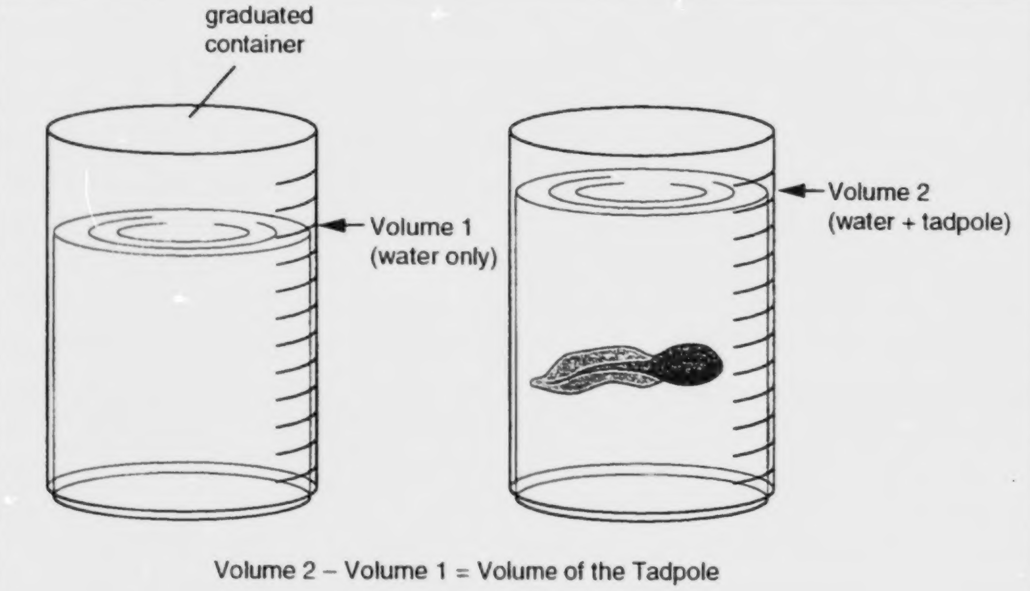
graduated container
Volume 1 (water only)
Volume 2 (water + tadpole)
Volume 2 – Volume 1 = Volume of the Tadpole

Figure 3.3.7(3) Finding the Volume of a Tadpole

3.3.8 IMPORTANCE OF FROGS AND TOADS

OBJECTIVES

The students
- Research the importance of frogs and toads to people.
- Report on the importance of frogs and toads to people.
- Create or revise their working definition of metamorphosis.

BACKGROUND

This activity is designed to give students an understanding of the value of frogs and toads to people and the environment.

The students work in pairs to do research that is shared with the class in a report. A format for the written report is provided on Student Page 3.3.8 FROG AND TOAD REPORT.

Frogs are a source of food for humans. Frogs and toads are a part of the natural control system for insects. Certain frogs and toads are used for their poisons by hunters in Latin America. Others are used to make folk medicines and as research organisms.

STUDENT ROLES

Researcher
Technological historian
Reporter

MATERIALS

reference books
Working Dictionary
Student Page 3.3.8 FROG AND TOAD REPORT

PRODUCTS

Class frog and toad reports
Working definition of metamorphosis
Completed Student Pages

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PROCEDURES

1. **Introduce the problem and have the class discuss the need to collect information on frogs and toads and their importance to people.**

   Help the students
   - Form research teams.
   - Discuss the contents of the report.
     ✔ See Student Page 3.3.8 FROG AND TOAD REPORT.
   - Select animals to research and report on.

2. **Have the student teams research their animals, write their reports using Student Page 3.3.8 FROG AND TOAD REPORT, and report on their research to the class.**

3. **Have the students create or revise their working definition of metamorphosis. Record it in the Working Dictionary.**

EXTENSION

- Have the students create a collage of frog and toad environments with a key to explain each type of habitat.

SUGGESTED REFERENCES

1987 Zim, Herbert S. and Smith, Hobart M.
Reptiles and Amphibians. (A Golden Nature Guide) Golden Press: NY.

1987 Reid, George K.
Pond Life. (A Golden Nature Guide) Golden Press: NY.

1980 DeManche, Sr. Edna Louise.
Small Animals of the School Neighborhood (Hawaii Nature Study Program) CRDG: Honolulu.

1977 Orlans, F. Barbara.
Animal Care From Protozoa to Small Mammals. Addison-Wesley Publishing Company: Menlo Park.

3.3.9 TOADS AND INSECTS

OBJECTIVES

The students
- Observe toads in their class garden.

BACKGROUND

After the students have completed the study of frogs and toads in Activity 3.3.7 FROG METAMORPHOSIS they release the adult toads and frogs into the environment. Toads may be put in the class garden where it is hoped they will stay and help with insect control. If possible the students study the life of a toad in a garden in this activity. If toads cannot be maintained in the class garden, this can be a home project.

STUDENT ROLES

Zoologist
Ecologist

MATERIALS

materials as requested to provide for the toads' needs in the garden
Student Page 3.3.9 GARDEN TOADS

PRODUCT

Completed Student Pages

PROCEDURES

1. **Before the students release the toads into their garden, have them discuss any needs the toads may have and plan to provide for them.**

   Help them include such things as
   - A constant food and water supply.

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- A cool, shaded place out of the sun.

2. **After the students have released the toads into their garden, have them discuss and list the questions they would like to investigate about the toads' behavior.**

   Some possible questions for the list include
   - Are the toads active during the day? What evidence do we have or need?
   - Are the toads active at night? What evidence do we have or need?
   - Where do the toads stay during the day?
   - How can we keep from stepping on the toads?
   - What do the toads eat? What evidence do we have or need?
   - How do the the toads seem to catch their food?
   - How do the toads seem to breathe?

3. **Have student teams collect data to answer their selected questions. Use Student Page 3.3.9 GARDEN TOADS.**

4. **Have the teams report to the class on their findings and generalizations about toads.**

   Record any unanswered questions about frogs or toads in the Wonder and Discover Book for later investigation.

EXTENSIONS

- Have students do a photo essay of toads in their garden.
- Have a class "Ode to a Toad" poetry and art contest.

3.3.10 HATCHING CHICKS

OBJECTIVES

The students
- Predict how long it will take for eggs to hatch.
- Predict the size the chicks will be when they hatch.
- Hatch chicks.
- Construct a brood box to raise the young chicks.
- Invent and construct food and watering devices for the brooder.

BACKGROUND

In this activity the students broaden their understanding of maturing animals by observing the hatching and growth of chickens. They predict how long it will take for a chick to hatch. They observe the incubation, identifying the things needed to artificially hatch eggs. The students construct a brooder for the newly hatched chicks. Special items needed for this project are an incubator and fertile eggs.

The use of a small commercial incubator is recommended. It may be purchased or borrowed from the school district central supply. Sometimes a pet store will rent incubators. Be sure to follow the instructions carefully. Note particularly that the air around the eggs must be moist and the eggs must be turned regularly. Commercial incubators will have a thermostat to ensure that the temperature is kept between 38° and 42° C.

Fertile eggs are available from hatcheries or from a farmer who has chickens. As an alternative to full-term hatching, 18-day-old eggs can be purchased from some hatcheries and the students can watch their development for just the last few days. The most exciting time is when the chicks break out of their shells. To increase the survival rate of the chicks, be sure to allow them to emerge from the shell on their own.

The brooder is constructed from a large cardboard box. See Figure 3.3.10(1). Inside the box there should be a smaller box with a door cut in it. This smaller box should be heated with a low wattage light bulb. The light bulb should be shielded with a tin can (with holes punched in it) to protect the chicks. The door is covered with fabric (cut into

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strips) to retain the heat and to allow free access to the warming box by the chicks. The chicks also require food (mash) and water. The food and watering devices are invented by the students. Two possibilities are illustrated in Figure 3.3.10(2).

STUDENT ROLES

Zoologist
Physiologist
Inventor

MATERIALS

large, heavy cardboard box (2 ft x 2 ft x 2 ft minimum)
smaller cardboard box (1 ft x 1 ft x 1 ft)
tin can (1 lb)
trouble light and cord
15- or 20-watt light bulb
jars or bottles
large jar lids
tin cans (tuna fish size)
stiff wire
pliers
newspaper
chart paper
markers
Student Page 3.3.10 HATCHING CHICKS

PRODUCTS

Class list on chick incubation
Responsibility chart
Brooder
Feeding device
Watering device
Hatched chicks
Completed Student Pages

PROCEDURES

1. **Introduce the activity of observing another kind of animal, a chicken, as it matures.**

   Have the students predict
   - How long it will take to hatch a chick.

- How big a chick will be when it emerges from its egg by drawing the shape of a chick the size they think it will be.

2. **Set up the incubator with the help of the students. Have the students develop and record a list of questions about incubation.**

   Help them include such questions as
   - What is the temperature of the incubator?
   - Does the temperature change much?
   - How is the temperature regulated?
   - How is the incubator heated?
   - Why do you think the air needs to be kept moist?
   - Does the hen keep the air around the eggs moist? How?
   - Why do the eggs have to be turned?
   - Does the hen turn her eggs?
   - How does the chick get out of the egg?
   - What happens to the egg white and yolk during incubation?

3. **Have the students organize the chicken hatching activity.**

   Help them include
   - A Responsibility Chart.
   - Regular observation of the eggs, temperature, etc.
   - Turning of the eggs.
   - Filling the water dish.
   - Attention over weekends.

4. **While waiting for the chicks to hatch have student groups build the brooder and invent and construct feeding and watering devices.**

5. **At the first sign of a hatching chick, invite the class to watch the process. Have the students record their observations on Student Page 3.3.10 HATCHING CHICKS.**

EXTENSIONS

- Invite a hatchery operator to visit the class to describe how chicks are hatched on a large scale.
- Have the students hatch different types of eggs and compare their observations of each.

ILLUSTRATIONS

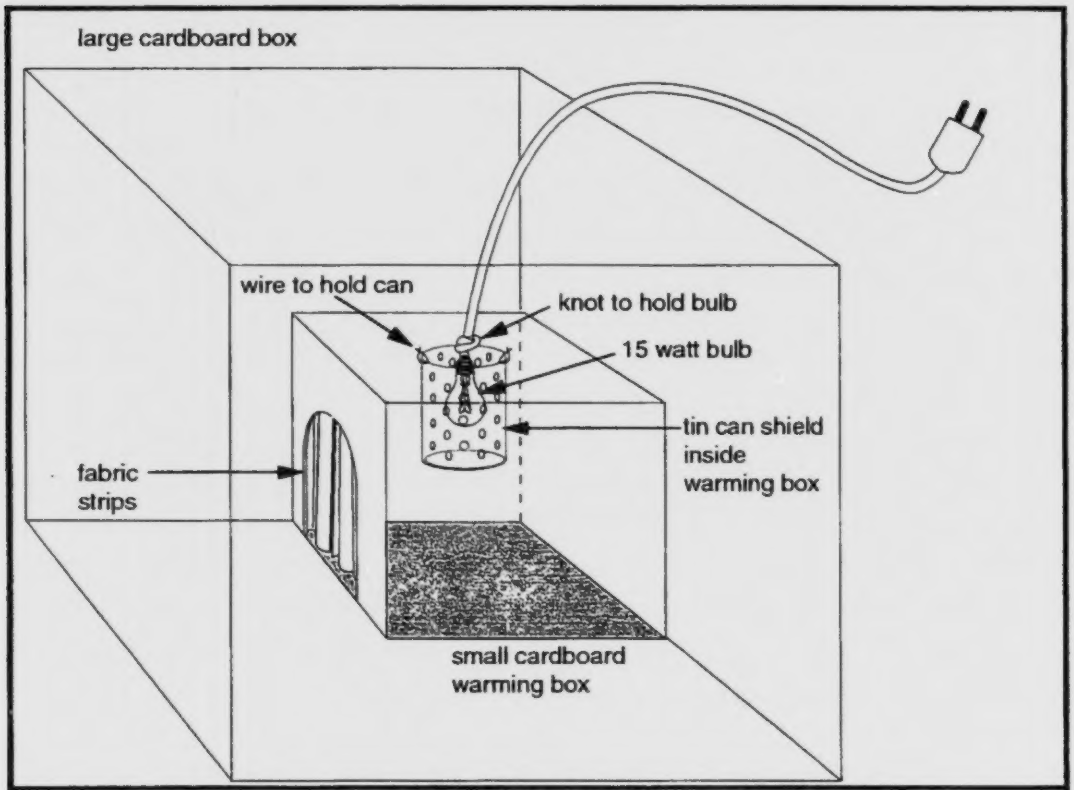
large cardboard box
wire to hold can
knot to hold bulb
15 watt bulb
tin can shield inside warming box
fabric strips
small cardboard warming box

Figure 3.3.10(1) Chick Brooder

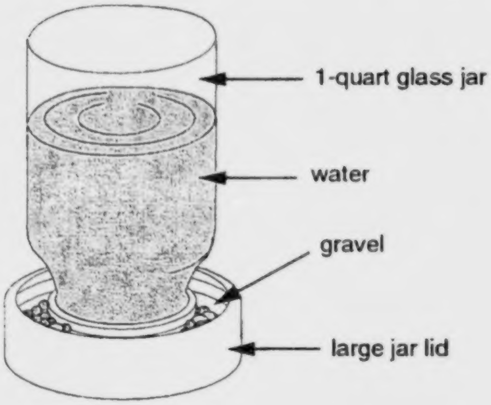
1-quart glass jar
water
gravel
large jar lid

Figure 3.3.10(2) Watering Device

3.3.11 CHICK GROWTH

OBJECTIVES

The students
- Observe the growth of chicks from hatching to maturity.
- Graph the growth of their chicks.
- Determine how much food it takes to raise a chick to maturity.
- Observe the variety of foods that chickens eat.
- Record their ideas about animal growth in the Connections Book.

BACKGROUND

The students study the growth of a chick in this activity. The idea of converting food to animal body mass is introduced. The students determine the number of grams of food that the chick eats to produce a gram of body mass. The activity also provides an opportunity to observe another animal grow to maturity.

Because chicks are social animals, at least three chicks should be observed in the study. The chicks can be identified by putting drops of different food colorings on the tops of their heads.

The growth of chicks is recorded by shadow drawings. Chicks will usually perch on a finger and remain still. Use a slide or filmstrip projector to cast light on a piece of drawing paper taped to a vertical surface. For the shadow on the paper to be an accurate representation of the chick's size, the projector should be three or four meters from the drawing paper. (The light is less divergent at this distance.) Place the chick on a finger perch close to the board so that the shadow falls on the paper. Trace the outline of the bird on the paper. Keep the distance between the paper and the projector and the paper and the bird the same each time the shadow is traced. Record the shadow profile of the bird every other day.

The students weigh the chicks. This calls for the invention of a suitable balance. See Activity 3.10.12 MEASURING DEVICES. The students also weigh all the food eaten by the birds.

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Feed the chicks mash when they first hatch. Since the food the chicks eat is measured, the eating surface of the feeder should be small enough to prevent the birds from scratching the food out. When the birds are several weeks old, they can begin to eat scraps of food from the cafeteria. Scraps are weighed before being fed to the birds and again when the uneaten food is removed from the cage. The amount of scraps eaten is the difference in the two measurements. This activity provides an excellent opportunity to integrate math skills.

Chicks can be raised in a box for 2-1/2 to 3 weeks. At the end of that time they will need more room. This may be the time to seek a home for the chickens and to end the study.

STUDENT ROLES

Zoologist
Physiologist

MATERIALS

graph paper
projector
tape
drawing paper
balance (See Activity 3.10.12 MEASURING DEVICES)
counterweights
chicken food
chicks and brooder from Activity 3.3.10 HATCHING CHICKS
Connections Book
Student Pages 3.3.11A CHICK GROWTH PREDICTIONS
3.3.11B CHICK GROWTH
3.3.11C CHICK FOOD EATEN
3.3.11D OTHER CHICK GROWTH OBSERVATIONS
3.3.11E CHICK GROWTH SUMMARY

PRODUCTS

Grown chickens
Completed Student Pages

PROCEDURES

1. **Have the students estimate how large they think the chicks will be in two weeks and in one month.**

Have them
- Draw a profile of the chick about the size they think it will be.
- Estimate the increase in the weight of the chick.
- Estimate how much food it will eat.
- Complete Student Page 3.3.11A CHICK GROWTH PREDICTIONS.

2. **Demonstrate for the students how to perch a chick on a finger and draw a shadow picture to record its growth.**

   Discuss with the students the need for
   - The projector to be the same distance from the paper each time.
   - The chick to be the same distance from the paper each time.
   - The chick to show the same profile each time.

3. **Have the students organize their groups to collect and record data. Use Student Pages 3.3.11B CHICK GROWTH and 3.3.11C CHICK FOOD EATEN.**

   Help the students to include
   - Identification of the chick.
   - Daily care of the chick.
   - Weekend care of the chick.
   - Daily weighing of the chick.
   - Daily weighing of chick food.
   - Recording the shadow pictures of the chick.
   - Recording other physical changes in the appearance of the chick.
   - A Responsibility Chart.

4. **Have the students develop their own questions to investigate the development of the chick. Use Student Page 3.3.11D OTHER CHICK GROWTH OBSERVATIONS to record questions and observations.**

Some suggested questions are
- How long will it take before the chick gets feathers?
- Do chicks shed their baby down?
- Does the chick shed its skin when it grows as insects do?
- Can chicks be trained?
- When do chicks sleep?
- How do chicks sleep?

5. **Have the students organize a summary and sharing session on the chicks. Use Student Page 3.3.11E CHICK GROWTH SUMMARY.**

6. **Have the students invent graphs to show the chicks' growth.**

7. **Have the class discuss their ideas about animal growth and development. Record their ideas in the Connections Book.**

   Ask such questions as these:
   - How are the ways animals grow and develop the same? Different?
   - Who needs to know about how animals grow and develop?
   - Why might growth information be important?

EXTENSIONS

Have the students
- Compare previous years' data to see whether their chick has eaten about the same amount of food per gram of feed.
- Calculate how much it would cost to raise a chick to table size, knowing the cost of chick feed.
- Make periodic prints of their chick's feet to record growth.

3.3.12 IMPORTANCE OF BIRDS

OBJECTIVES

The students
- Make a concept map about birds.
- Research the importance of birds.
- Report on their findings.
- Create or revise their working definition of birds.

BACKGROUND

This activity is designed to give the students an understanding of the value of birds to people. Throughout history birds have been used for their meat, eggs, and feathers. Bird manure was a source of the potassium nitrate used in gunpowder. Bird manure also makes an excellent fertilizer.

Have the students work in pairs to do the research and to report their information to the class. A format for the report is provided on Student Page 3.3.12 BIRD REPORT. Some interesting birds that can be suggested for the research project are chickens, geese, turkeys, pigeons, ducks, hawks, parrots, penguins, sparrows, condors, pheasants, ostriches, kiwis, owls, swans, crows, and eagles. Give the students the opportunity to select any bird they find intriguing. The only limiting factor should be the availability of resource materials.

STUDENT ROLES

Researcher
Technological historian
Reporter

MATERIALS

chart paper
markers
reference materials
Working Dictionary
Wonder and Discover Book

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Connections Book
Student Page 3.3.12 BIRD REPORT

PRODUCTS

Bird reports
Concept map on birds
Working definition of bird
Completed Student Pages

PROCEDURES

1. **Have the students make their concept map about birds.**

   Help them include such ideas as
   - Kinds.
   - Body parts.
   - Habitats.
   - Ways birds help or harm people.
   - Uses.
   - Needs.

2. **Introduce the activity of collecting information on birds and their value to people.**

   Help the students
   - Form research teams.
   - Discuss the contents of the report. See Student Page 3.3.12 BIRD REPORT.
   - Select a bird to research and report on that is from the suggested list or that they find especially interesting.

3. **Have student teams research their selected birds, write up their findings, and give their reports to the class.**

4. **Have the students add to their concept map about birds and create or revise their working definition of birds. Record their definition in the Working Dictionary.**

Record any remaining questions about birds in the Wonder and Discover Book.

5. **Have the students discuss the importance of knowing about birds. Record their ideas in the Connections Book.**

Ask such questions as these:

- Who else studies birds?
- How might this information be used?
- In what other ways might knowing about birds be important?

EXTENSION

- Have the students create a bulletin board display of each bird with its picture and description.

BIBLIOGRAPHY

1987 Zim, Herbert S. and Gabrielson, Ira N.
Birds. (A Golden Nature Guide) Golden Press: NY.

1980 DeManche, Sr. Edna Louise.
Small Animals of the School Neighborhood. (Hawaii Nature Study Program) CRDG: Honolulu.

DASH

PET CARE
SP 3.3.1

Name: ______________________

Date: ______________________

Name of Pet:	Kind of Animal:

Age:	Sex:	Color:

Other Information: ______________________

Pet's Needs	Plans to meet the Pet's Needs

DASH

INSECT OBSERVATIONS SP 3.3.2

Name: ______________________

Date: ______________________

INSECT:
COLLECTION LOCATION:
PREDICTIONS:

DATE	STAGE	OBSERVATIONS

QUESTIONS

DASH

MORE INSECT OBSERVATIONS
SP 3.3.3

Name: ______________________

Date: ______________________

INSECT:	STAGE:
QUESTIONS	OBSERVATIONS

DASH

INSECT REPORT
SP 3.3.4 Page 1

Name: ______________________

Date: ______________________

Research Team:
Common Name of Insect:
Scientific Name of Insect:
Draw and Label pictures of the life cycle of the insect.
Tell about the life cycle of the insect.
Where is the insect found?
Tell some interesting things about the insect.

DASH

INSECT
REPORT
SP 3.3.4 Page 2

Name: ______________________

Date: ______________________

Tell how the insect helps or harms people.

At what stage(s) in its life cycle is the insect helpful or harmful?

How is the insect controlled?

BIBLIOGRAPHY

Write the titles and authors of the books used to find out about the insect.

DASH

FROG AND TOAD HABITATS
SP 3.3.5

Name: ______________________

Date: ______________________

Draw and describe where frogs are found.

Draw and describe where toads are found.

DASH

MAKING FROG AND TOAD HABITATS
SP 3.3.6

Name: ____________________

Date: ____________________

Draw a picture of the frog and toad habitat and describe it.

DASH

FROGS AND TOADS
SP 3.3.7

Name: ____________________

Date: ____________________

Date	length (cm)	volume (mL)	mass (g)	Observations

DASH

FROG AND TOAD REPORT SP 3.3.8 Page 1

Name: ______________________

Date: ______________________

Title:
Research Team:
Kind of Animal:
Describe the natural habitat of the animal.
Draw and label a picture of your animal.
Write some interesting things you have learned about your animal.

DASH

FROG AND TOAD REPORT
SP 3.3.8 Page 2

Name: ____________________

Date: ____________________

How does your animal help people?

How does your animal harm people?

BIBLIOGRAPHY

Write the titles and authors of the books used to find out about your animal.

DASH

GARDEN TOADS
SP 3.3.9

Name: ______________________

Date: ______________________

List your questions and observations about toads in your garden.

QUESTIONS	OBSERVATIONS

HATCHING CHICKS SP 3.3.10

Name: ____________________

Date: ____________________

DATE	TIME	OBSERVATIONS

DASH

CHICK GROWTH PREDICTIONS
SP 3.3.11A

Name: ____________________

Date: ____________________

SIZE

On other sheets of paper draw the chick the size you think it will be in 2 weeks and in one month. Label and save your drawings.

WEIGHT

How much does the chick weigh now? ________

How much do you think it will weigh in two weeks? ________

How much food will the chick eat in two weeks to weigh that much? ________

How much do you think the chick will weigh in one month? ________

How much food will the chick eat to weigh that much in one month? ________

PREDICTIONS	NOW	TWO WEEKS	ONE MONTH
CHICK WEIGHT	grams	grams	grams
FOOD TO EAT		grams	grams

Will the amount of food the chick will eat be the same as the weight it will gain, less, or more? ________

OTHER PREDICTIONS:

DASH

CHICK GROWTH
SP 3.3.11B

Name: ____________________

Date: ____________________

DATE	WEIGHT OF CHICK (GRAMS)	WEIGHT CHANGE (GRAMS)

To find out how much the WEIGHT of the chick has changed:

WEIGHT OF THE CHICK TODAY − WEIGHT OF THE CHICK LAST TIME = CHANGE IN WEIGHT OF THE CHICK

DASH

CHICK FOOD EATEN
SP 3.3.11C

Name: ______________________

Date: ______________________

DATE	TOTAL WEIGHT OF FOOD GIVEN TO CHICK (GRAMS)	WEIGHT OF FOOD LEFT OVER (GRAMS)	WEIGHT OF FOOD EATEN (GRAMS)

To find the WEIGHT of the food eaten by the chick:

TOTAL WEIGHT OF FOOD GIVEN TO CHICK − WEIGHT OF FOOD LEFT OVER = WEIGHT OF FOOD EATEN

NOTE: If you have more than one chick find out the amount of food all the chicks ate. Divide this up into equal parts for each chick. For example: if 3 chicks ate 6 grams of food, each chick ate 2 grams. (2+2+2=6 or 6÷3=2)

DASH

OTHER CHICK GROWTH OBSERVATIONS
SP 3.3.11D

Name: ______________________

Date: ______________________

QUESTION:

DATE	OBSERVATIONS

DASH

CHICK GROWTH SUMMARY SP 3.3.11E

Name: ____________________

Date: ____________________

1. How much weight did your chick gain? ______ grams
2. How much food did your chick eat? ______ grams
3. How much food did it take to put one gram of weight on your chick? (Answer #2 ÷ Answer #1 = #3)*
4. Describe how your chick has changed.
* You may need to use a calculator or get help from your teacher.

DASH

BIRD REPORT
SP 3.3.12 Page 1

Name: ____________________

Date: ____________________

Research Team:
Common Name of Bird:
Scientific Name of Bird:
Draw and label a picture of the bird.
Describe the habitat of the bird.
Tell some interesting things about the bird.

BIRD REPORT
SP 3.3.12 Page 2

Name: ______________________

Date: ______________________

Tell how the bird is used and helps or harms people.

BIBLIOGRAPHY

Write the titles and authors of the books used to find out about the bird.

DASH

GRADE THREE
CLUSTER 4

PLANTS

3.4.1 Garden Planning
3.4.2 Garden Preparation
3.4.3 Watching Garden Soil
3.4.4 Making Artificial Soil
3.4.5 Testing Artificial Soil
3.4.6 Soil and Water
3.4.7 Garden Planting
3.4.8 Garden Care
3.4.9 Garden Watering Systems
3.4.10 Garden Invaders
3.4.11 Controlling Insects
3.4.12 Garden Harvesting
3.4.13 Flowers
3.4.14 Seeds
3.4.15 Pollination

3.4.1 GARDEN PLANNING

OBJECTIVES

The students
- Plan their garden.
- Organize to carry out their plan.

BACKGROUND

This activity introduces the class garden project. In the sequence the students plan, prepare, care for, and harvest a garden. Some of the produce will be prepared and eaten at the Class Feast, and some will be preserved. See Activities 3.5.4 PREPARING THE CLASS FEAST, 3.5.6 DRYING FOODS, and 3.5.7 PICKLING FOODS.

This activity is preceded by Activity 3.5.2 SELECTING PLANTS FOR THE GARDEN in which the students make a list of plants they could grow to supply a nutritious variety of the foods. This list is based on the DASH Activation, Regulation, and Fabrication (ARF) system for grouping foods. By grade 3, DASH students have had considerable experience in gardening and should lead discussion wherever possible. Activities 3.3.2–3.3.9 dealing with insects, toads, and frogs should be started before or during the garden project.

Before beginning, be sure to decide whether to work indoors or outdoors and the makeup of teams.

OUTDOOR GARDEN SITE. Prior to starting this activity, get agreement from the administration and grounds crew for a site to make an outdoor garden. Consideration should be given to minimizing vandalism. Three square meters (3 m x 1 m) or 27 square feet (9 ft x 3 ft) will provide adequate space for a garden. The students should allocate garden space according to the needs of the plants.

INDOOR GARDEN. If an appropriate outdoor site cannot be found, a molded heavy-weight plastic swimming pool can be used as a growing container. This can be put on wheels and rolled into the sunlight during the day. See Activity 3.7.1 GARDEN MOVER.

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Grow lights can also be used. Have the students look at seed packages to find quick-growing varieties. Because of size and light limitations, indoor gardens usually will not produce as much food as outdoor gardens. Do not be concerned about the quantity of food produced. To satisfy the requirements of the Class Feast, some foods can be purchased.

TEAM ORGANIZATION. There will be many different kinds of responsibilities that can be carried out by teams. There are six suggested teams.

- **The Planning Team** leads discussion of garden planning, harvests, and coordinates the activities of the other teams.
- **The Plant Selection Team** leads Activity 3.5.2 SELECTING PLANTS FOR THE GARDEN. It coordinates selection of plants to provide foods that will satisfy the ARF food group requirements. The team works with the teacher to get seeds and collect information about growing the plants.
- **The Plot Preparation Team** lays out the garden plot and allocates space for different plants, taking into consideration growth requirements. The team leads Activity 3.4.2 GARDEN PREPARATION.
- **The Planting Team** is responsible for timing the planting of the crops so that they ripen at about the same time. The team leads Activity 3.4.7 GARDEN PLANTING.
- **The Garden Maintenance Team** is responsible for setting up procedures for watering, weeding, and cultivating the plants. The team leads Activity 3.4.8 GARDEN CARE.
- **The Biological Control Team** is responsible for watching for insects, birds, and other organisms that may harm their crops. The team leads Activity 3.4.10 GARDEN INVADERS.

INFORMATION. Most of the information the students will need to make their garden is found on the back of seed packages. Information can also be found in agricultural extension service pamphlets. Extension service personnel, 4-H representatives, local gardening groups, and parents are often available to talk with students about gardening. Students who have gardened in previous years are another important resource. A Garden and Class Feast Consultant Team could be recruited from a fourth grade class.

STUDENT ROLES

Gardener
Agronomist
Horticulturalist

MATERIALS

Student Page 3.4.1 GARDEN PLANNING

PRODUCTS

Garden plan
Completed Student Pages

PROCEDURES

1. **Discuss making a class garden.**

   Include such ideas as
   - Growing foods for the Class Feast.
   - Growing the garden indoors or outdoors.
     ✔ If outdoors, discuss the location.
   - Growing foods that will provide the nutrients in each of the ARF food groups.
   - Organizing teams to do the work.

2. **Identify teams and describe their responsibilities.**

   - Planning Team—Coordination of planning.
   - Plant Selection Team—Coordination of selection.
   - Plot Preparation Team—Coordination of preparation.
   - Planting Team—Coordination of planting.
   - Garden Maintenance Team—Coordination of maintenance.
   - Biological Control Team—Coordination of pest control.

3. **Have the Planning Team lead the discussion for making plans for the garden. Help them to identify the jobs that must be done to make and maintain the garden. Have each team record their planning responsibilities on Student Page 3.4.1 GARDEN PLANNING.**

Include such things as
- Selecting plants that provide foods that will satisfy the ARF food group requirements for the Class Feast.
- Collecting information on how to grow the plants selected.
- Laying out the garden plot.
- Preparing the soil based on the soil data collected.
  ✔ See Activity 3.10.1 ACIDIC AND BASIC SOIL.
- Planting the seeds according to information and directions collected.
- Watering the plants.
- Weeding plants.
- Thinning the plants.
- Removing insects or using biological controls.
- Cultivating the plants.
- Staking tall or climbing plants.
- Harvesting the crops.

4. **If the garden is to be indoors, have the Planning Team lead the discussion for making and maintaining an indoor garden. Have each team record their planning responsibilities on Student Page 3.4.1 GARDEN PLANNING.**

Help them to include such things as
- A garden container.
- Maximum plant size.
- Water access.
- Drainage.
- Lighting.
- A transportation system to move the garden.

EXTENSIONS

Have the student teams
- Make up team names.
- Make up aphorisms and posters to describe their functions.

3.4.2 GARDEN PREPARATION

OBJECTIVES

The students
- Lay out their garden.
- Prepare the garden soil for planting.

BACKGROUND

Once the students have completed Activity 3.4.1 GARDEN PLANNING, the Plot Preparation Team coordinates plans for laying out the garden and preparing the soil for planting.

The Plot Preparation Team also plans for the safe use and maintenance of garden tools. After the tools have been rinsed clean, push the metal parts into a bucket of sand mixed with a can of used motor oil to prevent rust. Remove the tools from the sand and store.

An outdoor garden space of 1 meter by 3 meters should produce enough food for the Class Feast. Use the students' Meter-string Cans to lay out the boundaries. See Activity 3.10.12 MEASURING DEVICES. Allocate space based on the needs of the selected plants.

If the ground is hard, try to find someone to till it for the class. Add the compost made in Activity 3.9.1 MAKING COMPOST to the soil. Test the acidity of the soil to determine whether additives are needed. See Activity 3.10.1 ACIDIC AND BASIC SOIL. Further advice from the agricultural extension service, gardeners, or a garden shop may be helpful.

If the garden is to be grown indoors, a child's heavy-weight molded-plastic swimming pool can be used as a container. If the garden container is put on wheels, it can be moved into and out of the classroom or into the sunlight. See Activity 3.7.1 GARDEN MOVER. Use potting soil for the best results.

Plan for light and water access. Grow lights can be used where sufficient sunlight is not available. Drainage for excess water should be considered. A 2-3 inch layer of gravel with a small amount of activated

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(aquarium) charcoal will serve as an alternate to putting holes in the bottom of the container. Be careful of overwatering.

STUDENT ROLES

Agronomist
Gardener

MATERIALS

shovels
rakes
cultivating forks
meter-string can (See Activity 3.10.12 MEASURING DEVICES.)
12–14 wooden stakes, 15 cm (6 in)
hammer
string
bucket of sand
used motor oil, 1 quart
compost
indoor garden:
    child's large heavy-weight molded-plastic swimming pool
    potting soil
    gravel
    activated (aquarium) charcoal
    grow lights (optional)
Student Page 3.4.2 GARDEN PREPARATION

PRODUCTS

Garden preparation plan
Garden preparation responsibility chart
Garden, ready to plant
Completed Student Pages

PROCEDURES

1. **Have the Plot Preparation Team lead a class discussion to consider what needs to be done to prepare the garden for planting.**

   If the garden is to be outdoors, help the team include such things as
   - Plot size.

- Plot location.
- Boundary markers.
  ✔ Need for stakes, Meter-string Cans, string, signs, etc.
- Addition of compost.
- Soil conditioning.
  ✔ Help in spading or tilling.
- Breaking up clods to make planting soil.
- Soil testing.
  ✔ See Activity 3.10.1 ACIDIC AND BASIC SOIL.
- Care and use of equipment.

If the garden is to be indoors, help the team include such things as

- Kind of container.
- Location.
- Soil.
- Drainage.
- Water source.
- Light sources.

2. **Have the Plot Preparation Team make a Responsibility Chart of the jobs that need to be done to prepare the garden plot.**

   Have the team
   - Ask the class to sign up for the jobs.
   - Supervise the gathering of equipment and supplies.
   - Demonstrate the safe use and care of garden equipment.
   - Oversee and coordinate the preparation of the plot according to the team's plan.

3. **Have the Plot Preparation Team make an illustrated report of its functions and lead a discussion of the team's contributions to the gardening project.**

EXTENSIONS

Have the students
- Start a bulletin board display on the Class Garden.
- Display the Plot Preparation Team's Report as the first contribution.

3.4.3 WATCHING GARDEN SOIL

OBJECTIVES

The students
- Invent a way to observe their garden soil as plants grow in it.
- Observe what occurs as plants grow in their garden soil.

BACKGROUND

This activity parallels Activity 3.9.2 WATCHING COMPOST. The students invent ways to watch the processes that are going on in their garden soil as plants grow in it. They can invent a way to make their observations directly in the garden or use something similar to the plastic soda bottle system used to observe compost.

STUDENT ROLES

Agronomist
Botanist
Inventor

MATERIALS

2-liter plastic soda bottles
soil from the class garden
garden plants grown from the same batch of seeds used in the garden
hand trowel
water container
other materials as requested by the students.
Student Pages 3.4.3A GARDEN SOIL OBSERVATION PLAN
3.4.3B GARDEN SOIL OBSERVATIONS

PRODUCTS

Garden soil observation systems
Completed Student Pages

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PROCEDURES

1. **Have student groups invent ways to observe garden soil as plants grow in it. Have them use Student Page 3.4.3A GARDEN SOIL OBSERVATION PLAN to record their designs.**

   Ask such questions as these:
   - How could you observe what is happening to the soil in the garden?
   - How could you get soil that is the same as the soil in the garden?
   - How could you keep the conditions in an observation system the same as those in the garden?
     ✔ Work toward the idea that everything that is done to the soil in the garden should be done to the soil in the observation system.
   - How can you be sure that any plants grown in the observation system will get enough light?
   - How could you measure the acidic and basic condition of the soil in the observation system and compare it with the soil in the garden?
   - How could you be sure the amount of water received in the observation system is similar to that in the garden?

2. **Have the students observe the garden soil in their observation system and report changes at least once a week. Have them use Student Page 3.4.3B GARDEN SOIL OBSERVATIONS.**

3. **Summarize the activity with the class.**

   Ask such questions as these:
   - How does the soil in your observation system compare with the soil in the garden?
   - Did any animals appear in the system? What happened to them?
   - Was there a change in the color of the soil in the system? What seemed to cause it?

- How do your observations of the garden soil system compare with your observations of the compost?

EXTENSION

- Have the students continue to watch the garden soil in the observation system after the plants have been harvested and mulched.

3.4.4 MAKING ARTIFICIAL SOIL

OBJECTIVES

The students
- Make concept maps about soil and about things that do not decompose.
- Make artificial soil out of materials that do not decompose.
- Test their artificial soil for acidity and water absorbency.
- Compare the absorbency of natural and artificial soils.

BACKGROUND

This activity expands on the students' understanding of soil and uses their prior knowledge from their study of decomposition. It should be done after Activity 3.10.1 ACIDIC AND BASIC SOIL and be followed by Activity 3.4.5 TESTING ARTIFICIAL SOIL.

The students are challenged to make an artificial soil from materials that do not usually decompose. Shredded Styrofoam, small pieces of plastic and metal, and pebbles are some of the ingredients they may select for their recipe. If they choose to include glass, it can be prepared by filling a small heavy glass jar 1/4 full of broken glass, sealing it, and shaking it until the sharp edges of the glass are worn down. Add some all-purpose granulated fertilizer to the recipe if plants are to be grown in the soil.

Water absorbency of the artificial soil can be determined using the following procedure.
- Punch drainage holes in the bottom of the soil container.
- Put a measured amount of soil in the container.
- Place another container under the soil container to catch any water that drains through the soil.
- Pour a measured amount of water into the container of soil.
- Measure the amount of water that drained out of the soil container.
- Subtract this amount from the amount of water poured into the container of soil to find the amount of water the soil retained or absorbed.

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All groups should use the same amounts of soil and water and the same kind and shape of container to make comparisons straightforward.

STUDENT ROLES

Agronomist
Inventor

MATERIALS

chart paper
markers
clear plastic cups
waste Styrofoam
waste plastic
metal or foil pieces
other non-decomposing materials as requested by the students
scissors
granular all-purpose fertilizer
natural soil
volume jars (See Activity 3.10.12 MEASURING DEVICES)
Student Page 3.4.4A ARTIFICIAL SOIL RECIPE
3.4.4B TESTING ARTIFICIAL SOIL

PRODUCTS

Concept map on soil
Concept map about things that do not decompose
Artificial soil
Completed Student Pages

PROCEDURES

1. **Have the students make a concept map about soil.**

   Help them include such things as
   - Sand.
   - Rocks.
   - Composted matter.
   - Rock.
   - Animals.

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✔ worms, insect larva, etc.

- Molds.
- Water.
- Fertilizers and other additives.
- Plant parts.

2. **Have the students make a second concept map about things that do not decompose.**

   Help them include such things as
   - Metals.
   - Plastics
     ✔ Styrofoam, soft and hard plastics, etc.
   - Glass.
   - Rocks.

3. **Using the two concept maps, discuss whether things that do not decompose can function as soil.**

   Ask such questions as these:
   - How are non-decomposing things like soil?
   - How are non-decomposing things different from soil?
   - How might you make artificial soil out of non-decomposing things?
     ✔ Get at the idea of breaking them up into small pieces.
   - What do some people add to soil to help plants grow better?
     ✔ Get at the idea of adding fertilizer.

4. **Have student groups invent artificial soil recipes from things that do not decompose. Each group will need about 250 mL (1 cup) of material.**

   Have the groups
   - Make their artificial soil.
   - Record how much of each material they use on Student Page 3.4.4A ARTIFICIAL SOIL RECIPE.

- Record how they granulated, broke-up, or shredded materials.

- Glue a sample of each material to the Student Page.

5. **Have the students invent a way to find out how much water their artificial soil will hold. Have them record their observations on Student Page 3.4.4B TESTING ARTIFICIAL SOIL.**

   Have the groups
   - Pack their container with a measured amount of artificial soil.
   - Invent a way to find out how much water the soil holds.
   - Test their artificial soil for water absorbency.
   - Test the water absorbency of a natural soil.

6. **Summarize the activity with the class.**

   Ask such questions as these:
   - How is your artificial soil similar to natural soil?
   - How is your artificial soil different from your natural soil?
   - How did the water absorbency of fine-grained artificial soils compare with the absorbency of coarse-grained artificial soils?
   - How does water seem to be absorbed in soil?
     ✔ Work toward the idea that the water seems to stick to the soil particles.

EXTENSIONS

Have the students
- Compare their artificial soil with commercial vermiculite and perlite potting mixes.
- Make a class bar graph to compare the water absorbency of the artificial soil made by each group.

3.4.5 TESTING ARTIFICIAL SOIL

OBJECTIVES

The students
- Test artificial soil to see whether it will support plant growth.
- Design and carry out their own tests of the ability of their artificial soil to support plant growth.
- Report on the results of their experiments.

BACKGROUND

This activity follows Activity 3.4.4 MAKING ARTIFICIAL SOIL. The students design and carry out their own experiments using the artificial soil they made from materials that do not usually decompose. Mung beans and radish seeds give quick growth results. Other seeds such as cherry tomatoes or bush beans can also be used.

Kill any mold in the system before starting the experiment. First, wash the soil and container in a bleach solution (5 mL liquid bleach to a liter of water or 1 tbsp bleach to a quart of water). Then thoroughly rinse both the container and the soil three or four times in fresh water.

Add granular fertilizer only after the mold-removing process has been completed. Test the pH of the artificial soil and adjust as needed. See Activity 3.10.1 ACIDIC AND BASIC SOIL.

If the students' systems fail at any point, the test can be revised and the soil can be reused.

STUDENT ROLES

Agronomist
Botanist

MATERIALS

clean plastic containers
artificial soil from Activity 3.4.4 MAKING ARTIFICIAL SOIL
granulated all-purpose fertilizer

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nails or ice pick
seeds
water containers
Student Page 3.4.5 TESTING SOIL

PRODUCTS

Planting containers
Mature plants
Completed Student Pages

PROCEDURES

1. **Have student groups design experiments to test the ability of their artificial soil to support plant growth.**

   Help them to consider such things as
   - The plants to grow.
   - The containers to use.
     ✔ Have them discuss the advantage of being able to watch their soil.
   - How their plants will receive light.
   - How they will fertilize their plants.
     ✔ Use granulated all-purpose fertilizer.
   - How they will test and adjust the pH of their soil.
     ✔ See Activity 3.10.1 ACIDIC AND BASIC SOIL.
   - The method, amount, and schedule for watering.
   - A record-keeping plan.
     ✔ Work toward a twice-a-week measurement of height and a general description of the appearance of the soil and plant.

2. **Have the students prepare their soil and carry out their experiments.**

   Have them
   - Kill any mold in their soil with bleach.
   - Add fertilizer.

- Adjust the pH.
- Carry out their experiment.

3. **Have the students write a report on their experiment and share their results with the rest of the class.**

4. **Summarize the experiment with the class.**

   Ask such questions as these:
   - How well did your soil grow plants?
   - What problems, if any, did you have?
   - How is your artificial soil similar to natural soil?
   - How is your artificial soil different from natural soil?

EXTENSION

- Have the students test artificial soil without fertilizer.

3.4.6 SOIL AND WATER

OBJECTIVES

The students
- Set up an experiment to test the capacity of soils to support plant life with different amounts of water.
- Make reports on their findings.

BACKGROUND

In this activity the students experiment to see what effect watering has on plant growth. It is an extension of the investigation begun in Activity 3.4.3 WATCHING GARDEN SOIL. The students design and organize the experiment. This is an example of a cooperative research project. It reinforces Activity 3.1.8 WORKING TOGETHER.

The students work in groups to design and carry out a cooperative research experiment. All the conditions should be controlled except for the amount of water. For example, one container might have no water added after the initial watering, another container might receive 10 mL each week, and so on. Identical containers, the same kind of soil, the same type of seeds, and equal amounts of light are all conditions to be considered. If clear plastic containers without drainage holes are used for planting, water will be conserved. Using such a system will likely lead to a broader investigation that will include the problem of too much as well as too little water. The students should use the volume jars made in Activity 3.10.12 MEASURING DEVICES to make all measurements.

Mung beans or radishes are some quick-growing plants.

STUDENT ROLE

Agronomist

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MATERIALS

clear plastic containers
soil
seeds
water
volume jars (See Activity 3.10.12 MEASURING DEVICES)
Student Page 3.4.6A SOIL AND WATER EXPERIMENT
3.4.6B SOIL AND WATER REPORT

PRODUCTS

Experiment reports
Completed Student Pages

PROCEDURES

1. **Have the class design a cooperative experiment to test the growth of plants using different watering schedules.**

   Help the class consider such things as

   - What soils to use.
     ✓ Use the same soil in all containers.

   - What plant is to be grown.
     ✓ Use one kind of plant.

   - How many seeds are to be used in each container.
     ✓ Use the same number in all containers.

   - What containers are to be used.
     ✓ Explore the advantage of being able to watch their soil. Use the same kind of containers.

   - How much soil should be used.
     ✓ Use the same amount in each container.

   - How plants will receive light.
     ✓ All plants should receive the same amount of light.

   - How much water each plant is to receive.
     ✓ This is the variable in the experiment.

   - How and when plants are to be watered.
     ✓ This should be the same for all plants that are watered.

- How records are to be kept.
  ✓ Work toward a minimum of twice-a-week measurement of height and a general description of the soil and plants.

- How the responsibilities should be divided.

2. **Have the students carry out the experiment. Have them use Student Page 3.4.6A SOIL AND WATER EXPERIMENT to record their observations. If the system fails at any point, fresh soil can be used and the experiment can be repeated.**

3. **Have the students write individual reports on their part of the experiment. Use Student Page 3.4.6B SOIL AND WATER REPORT. Then have each group present an oral report.**

4. **Summarize the experiment with the class.**

   Ask such questions as these:
   - What happened when the plants received too little water?
   - What happened when the plants received too much water?
   - How did the amount of water affect plant growth?
   - Which watering plan gave the best results?

EXTENSIONS

Have the students
- Test their artificial soils using different watering schedules.
- Find seeds of plants that need little water and grow them with various watering schedules. (For example, wild flowers.)

3.4.7 GARDEN PLANTING

OBJECTIVES

The students
- Collect information on planting a garden.
- Plan for planting their garden.
- Plant their garden.

BACKGROUND

This activity follows Activity 3.4.2 GARDEN PREPARATION and Activity 3.5.2 SELECTING PLANTS FOR THE GARDEN. The students plan and carry out the planting of their garden. This activity will require that the Planting Team carefully coordinate with the Plant Selection Team so that as many plants as possible will be ready for harvest at the same time.

Specific information on the planting requirements for each kind of plant can usually be found on the back of seed packages. The Planting Team makes a list of requirements for each type of plant to be grown in the garden. The team then makes a map of the garden showing where the seeds will be planted.

STUDENT ROLE

Gardener

MATERIALS

chart paper
markers
seeds
seed packages
trowels
rakes
hose
meter-string cans (See Activity 3.10.12 MEASURING DEVICES)
bucket of oily sand (See Activity 3.4.2 GARDEN PREPARATION)
Student Page 3.4.7 GARDEN PLANTING

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PRODUCTS

Map of the garden
Garden planting responsibility chart
Planted garden
Completed Student Pages

PROCEDURES

1. **Have the Planting Team collect information on the planting of seeds to be grown in the class garden. Have the students use Student Page 3.4.7 GARDEN PLANTING.**

2. **Have the Planting Team lead a class discussion on planting.**

   Help the team include such things as
   - The kind of plants to be grown.
   - The best location for these plants in the plot.
     ✔ Consider height, space, and light requirements.
   - The timing of the planting so that as many plants as possible will be ready for harvest in time for the Class Feast.
   - How the seeds are to be planted.
     ✔ Depth, distance apart, special conditions, etc.
   - How to mark the location of rows.
   - The location and the making of any irrigation ditching.
   - The safe use and care of equipment.

3. **Have the Planting Team make a map showing where the seeds are to be planted in the garden and make a schedule of when the seeds are to be planted.**

4. **Have the Planting Team make a Responsibility Chart for planting the garden.**

   Have them
   - Ask the class members to sign up for planting jobs.
   - Supervise the gathering of equipment and supplies.

- Coordinate the planting of the garden according to their plan.

5. **Have the Planting Team make an illustrated report of the team's functions and lead a discussion of its contribution to the gardening project.**

EXTENSIONS

Have the students

- Add the Planting Team's Report to the bulletin board display on the garden.
- Make a class book on the needs of the plants in their garden using Student Pages 3.4.7 GARDEN PLANTING.

3.4.8 GARDEN CARE

OBJECTIVES

The students
- Identify the jobs necessary to care for their garden.
- Make a plan to care for their garden.
- Carry out their plan.

BACKGROUND

This activity follows Activity 3.4.7 GARDEN PLANTING and precedes Activity 3.4.9 GARDEN WATERING SYSTEMS. The students plan for the care of their garden and coordinate garden maintenance. This activity requires careful monitoring of responsibility charts.

STUDENT ROLES

Inventor
Gardener

MATERIALS

hand cultivators
shovels
rakes
hoes
hose or other watering equipment
bucket of oily sand (See Activity 3.4.2 GARDEN PREPARATION)
Student Page 3.4.8 GARDEN CARE

PRODUCTS

Well-maintained garden
Garden care responsibility chart
Completed Student Pages

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PROCEDURES

1. **Have the Garden Maintenance Team collect information on care of the plants to be grown in their garden.**

   Have the team
   - Use the information on the seed packages.
   - Use Student Page 3.4.8 GARDEN CARE to record the information.

2. **Have the Garden Maintenance Team lead a class discussion about caring for the garden.**

   Help the team include such things as
   - Watering plants.
     ✔ How and when.
   - Pulling weeds.
     ✔ How can weeds be identified? Have the students organize a weed watch inside and outside the plot to get an answer.
   - Cultivating plants.
   - Thinning plants.
   - Staking plants.

3. **Have the Garden Maintenance Team make a Responsibility Chart for garden care.**

   Have the team
   - Ask the students to sign up for garden care jobs.
   - Supervise the gathering and maintaining of equipment and supplies.
   - Oversee and coordinate the care of the garden by monitoring the Responsibility Chart and what is happening in the garden.
   - Revise the Responsibility Chart as needed.

4. **Have the Garden Maintenance Team make an illustrated report of the team's work and lead a discussion of its contribution to the gardening project.**

EXTENSIONS

Have the students
- Add the Garden Maintenance Team's Report to their bulletin board display on the class garden.
- Make a Class Garden Care Information Book.

3.4.9 GARDEN WATERING SYSTEMS

OBJECTIVES

The students
- Invent a garden watering system.
- Test their garden watering system.
- Modify their garden watering system as needed.
- Use their system to water the class garden.

BACKGROUND

This activity is part of the gardening sequence which follows Activity 3.4.1 GARDEN PLANNING and precedes Activity 3.4.8 GARDEN CARE. In this activity the students invent a way to water their class garden.

Factors determining the scope of invention of watering systems may include the amount of time that is given to the project, where the garden plot is located (classroom, hillside, near a faucet, away from a building, etc.), how protected the garden is, and how much control the teacher has over the area around the garden.

The scope of invention can be controlled and enhanced by problems the teacher creates. Some outdoor garden problems might be created by the use of hoses that are too short to reach the garden, hoses that cannot be attached to faucets, or ditches that can be dug only in the garden. Indoor garden problems that can stimulate invention can be created by stipulating that the watering system can use only aquarium tubing to deliver water, that the system must be movable, or that the water must come from a reservoir (bucket).

The students should go through all the stages of engineering in this project. They should invent, build, test, modify, retest, and operate their watering system.

STUDENT ROLES

Hydraulic engineer
Gardener

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MATERIALS

as required by student design
Student Page 3.4.9 GARDEN WATERING SYSTEM

PRODUCTS

Garden watering system
Completed Student Pages

PROCEDURES

1. **Introduce the problem of watering the class garden by setting the conditions the system must meet. Have the students work in groups to come up with designs. Have them use Student Page 3.4.9 GARDEN WATERING SYSTEM to record their designs.**

   Ask such questions as these:
   - How do you propose to water the garden plot or container?
   - How many people will it take to run the system once it is built?
   - Can it operate over weekends?
   - What materials will you need?
   - Will the system look nice?

2. **Have the students decide which system they will build. Have them organize to build, test, and use that system.**

   Ask such questions as these:
   - What system should you use?
   - Why have you selected that particular system?
   - How are you going to organize to build the system?
   - How will you test and modify the system?
   - How will you operate the system?

3. **Have the students operate their system while their garden is growing. At the end of the gardening project discuss the effectiveness of their garden watering system.**

   Ask such questions as these:
   - What problems did you have with your watering system? Why?
   - If you were to build another system, how would you do it differently?

EXTENSION

- Have the students report on different ways crops are irrigated throughout the world.

3.4.10 GARDEN INVADERS

OBJECTIVES

The students
- Set up a garden invader watch.
- Plan how to deal with insects, birds, and other invaders.
- Carry out their plans as needed.

BACKGROUND

As background to this activity it is best to have begun Activities 3.3.2–3.3.9 dealing with insects, frogs and toads. This activity follows Activity 3.4.8 GARDEN CARE. The students make plans to get rid of garden pests such as insects, birds, and other unwanted invaders. Encourage the students to think in terms of biological control of insects and other non-chemical responses to garden invaders. Control of insect pests is explored in depth in Activity 3.4.11 CONTROLLING INSECTS which should be led by the Biological Control Team.

The students can get information about insect control from such sources as garden shops, nurseries, parents, friends who garden, and extension service pamphlets. This is the time to discuss the fact that insecticides are poisons that can kill organisms other than the ones doing damage to their plants.

One safe and effective way to protect plants is to simply remove insects by hand. Another environmentally safe method to drive off most insects is to spray the plants with a weak solution of detergent. The students may want to introduce toads, spiders, and other helpful insects to their garden. Marigolds planted near food plants help keep some insects away.

STUDENT ROLES

Entomologist
Gardener

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MATERIALS

chart paper
markers
toads
spiders
ladybugs
praying mantises
marigolds
detergent
spray bottle
cans
fence material (optional)
materials for a scarecrow
other materials as requested by the students
Student Page 3.4.10 GARDEN INVADERS

PRODUCTS

Concept map about garden invaders
Plans to protect the garden
Completed Student Pages

PROCEDURES

1. **Have student groups make concept maps about garden invaders.**

   Help them include such things as
   - Kinds of garden invaders.

   - Ways to get rid of garden invaders.

2. **Have the Biological Control Team do research on insects and ways to control other garden invaders.**

   Have the team
   - Collect information on how to control different kinds of common garden insect pests.

   - Discuss with gardeners, garden shop operators, and others the use of non-chemical methods to control insects.
     ✔ Note their advantages and disadvantages.

- Collect information on what kinds of ingredients are found in recommended insecticides.
  ✔ Note their hazards to humans and other animals as well as their advantages.

- Choose several potential control methods to be used if insects invade the garden.

3. **Have the Biological Control Team lead a class discussion using the group concept maps about identifying and dealing with garden invaders.**

   Help the students include such things as
   - How you can tell when insects are invading the garden.

   - What you can do to rid the garden of harmful insects.
     ✔ Help them discuss introducing resident toads, spiders, praying mantises, and ladybugs; washing the leaves with detergent; planting marigolds.

   - How you can tell when other animals invade our garden?
     ✔ Include birds and humans.

   - What you can do to get rid of these other kinds of invaders.
     ✔ Help them discuss the use of fencing, signs, and scarecrows.

   - Discuss Activity 3.4.11 CONTROLLING INSECTS.

4. **Have the Biological Control Team make a plan to deal with each of the garden invaders identified in the class discussion. Have the students use Student Page 3.4.10 GARDEN INVADERS.**

5. **Have the Biological Control Team make a Responsibility Chart to prepare for and deal with any garden invaders.**

   Have the team
   - Ask the class members to sign up for jobs.

   - Supervise the gathering and preparation of supplies and equipment.

   - Oversee and coordinate the elimination of any garden invaders according to the team's plans.

6. **Have the Biological Control Team make an illustrated report on the team's functions and lead a discussion of its contribution to the gardening project.**

EXTENSIONS

Have the students

- Add the Biological Control Team's Report to the bulletin board display on the class garden.
- Make a book about Garden Invaders.

3.4.11 CONTROLLING INSECTS

OBJECTIVES

The students
- Investigate ways to control various insects in their garden.
- Experiment with methods of controlling insects in their garden.
- Compare insect control techniques.

BACKGROUND

This activity introduces a research project on the effectiveness of insect control methods. It follows 3.4.10 GARDEN INVADERS. It should be introduced when students find evidence of insect damage in their garden. Different methods of insect control are researched.

The students set up studies of the effectiveness of different methods to protect their plants. Compare a treatment method with doing nothing to the plant. The untreated plants are called **controls**. Wherever possible test each treatment with five or more plants. Help the students understand that results from treating only one or two plants might be accidents. They should use the same number of control and treatment plants.

CAUTION: Commercial insecticides should be applied only by an adult using appropriate protection. The students should be kept away from the garden until the insecticides dissipate. Follow the instructions found on the products carefully. Do not use any insecticides that are not properly documented or that are beyond their expiration date.

STUDENT ROLES

Gardener
Entomologist

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MATERIALS

concept maps about garden invaders (See Activity 3.4.10 GARDEN INVADERS.)
toads
spiders
ladybugs
praying mantises
marigolds
detergent
spray bottle
cans
fence material
scarecrow materials
other materials as requested by the students
Student Page 3.4.11 INSECT CONTROL

PRODUCTS

Insect-free garden
Completed Student Pages

PROCEDURES

1. **When the students observe insect damage or insects in their garden, have them set up their experimental studies. Have them use Student Page 3.4.11 INSECT CONTROL to record their data.**

   Have them
   - Record the amount of damage observed after each control method is started.
   - Record the amount of produce recovered from plants treated by different methods.
   - Use at least two different methods with each kind of plant.
   - Note that doing nothing to the plant is considered as one method.
   - Use five or more plants with each method whenever possible.
   - Record the number of insects that they remove or find dead where the methods used involves killing or removing insects.

2. **Have each group report to the class on the success of their insect control method.**

EXTENSIONS

- Invite a county agriculture agent to talk about controlling insects.
- Invite local gardeners to talk about how they cope with insects. Try to get a balance between environmentally motivated gardeners and commercial gardeners.

3.4.12 GARDEN HARVESTING

OBJECTIVES

The students
- Observe how foods are stored after they are harvested.
- Harvest their garden.
- Store their harvested food.
- Clean and store their garden equipment.

BACKGROUND

This is the final activity in the gardening sequence. In this activity the students plan and carry out the harvesting of their garden. The activity is designed to get the students to consider how food should be stored prior to preparing it for eating and what should be done with the garden plants after the food parts have been harvested.

STUDENT ROLE

Gardener

MATERIALS

seed packages
cultivating forks
shovels
hoes
storage bags for food
refrigerator
sink
bucket of oily sand (See Activity 3.4.2 GARDEN PREPARATION)
Student Page 3.4.12 GARDEN HARVESTING

PRODUCTS

Stored food
Completed Student Pages

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PROCEDURES

1. **Have the Planning Team lead a class discussion on harvesting the class garden. Have the students record their ideas on Student Page 3.4.12 Garden Harvesting.**

   Help the students include such things as
   - How you can tell when plants are ready to harvest.
     ✔ Work to the ideas of looking at the food parts to see whether they look like those in food stores and getting information from seed packages.

   - What to do with the food after it is harvested so that it does not spoil.
     ✔ Get at the idea that they can observe what supermarkets do with produce and the way it is kept at home.

   - Where to store the harvested food.
     ✔ Work toward the idea of getting refrigerator space.

   - What to do with the remaining plants in the garden once the harvesting is over.
     ✔ Work to the idea of composting.

   - What to do with tools and equipment once the gardening project is complete.

2. **Have the Planning Team make a Responsibility Chart of the harvesting jobs.**

   Have the team
   - Ask the class members to sign up for harvesting jobs.

   - Make the arrangements for refrigeration.

   - Oversee the carrying out of their harvesting plan.

   - Oversee the cleaning and storage of the gardening equipment.

3. **Have the Planning Team make an illustrated report on the harvesting and lead a summary discussion of the gardening activities.**

EXTENSION

Have the students
- Add the Planning Team's Report on Harvesting to the bulletin board display on the class garden.

DASH 3.4.13 FLOWERS

OBJECTIVES

The students
- Dissect flowers.
- Identify the flower parts.
- Make a herbarium sheet showing the parts of the flower.

BACKGROUND

This is the first of three activities dealing with plant reproduction. It is usually done before plants begin to grow in the class garden. The students dissect several kinds of flowers and identify their parts.

Some flowers may be found on the school grounds. Be sure the students get permission from the grounds maintenance staff before picking any campus flowers. Flowers can also be brought from home gardens. An ample supply can often be obtained from the discards of florist shops or funeral homes.

Large blooms from lilies or hibiscus plants have easily identifiable parts. See Figures 3.4.13(1) and 3.4.13(2). Most flowers can be dissected with a fingernail or a straight pin. Have a single-edged razor blade or an Exacto knife on hand to help students who find the ovaries difficult to open.

This is an opportune time to introduce the students to the scientific terms for the parts of a flower. As in the case of animal terminology, these words are useful in talking about particular plant processes. See Figures 3.4.13(1) and 3.4.13(2). The primary function of a flower is to reproduce the plant. Each part of the flower has a particular role in this process. The green **sepals** found under the petals protect the flower during the bud stage. The **petals** surround the reproductive parts of a flower. The petals protect these parts and attract insects. The essential parts of a flower are the **pistil** (female parts) and **stamens** (male parts). A flower usually has several stamens. Each stamen has a thin stalk or **filament**. At the top of the stamen is an **anther** which holds a yellow or reddish powder made up of **pollen** grains. The pistil is located in the center of a flower. The sticky knob

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on top, called the **stigma**, catches the pollen. The stigma is supported by the **style** which connects it to the **ovary**. The ovary is the fat part at the bottom of the pistil. Inside the ovary are **ovules** containing eggs which grow into seeds after they have been fertilized by sperm in the pollen grains.

STUDENT ROLE

Botanist

MATERIALS

flowers
hand lenses
straight pins
Exacto knife or single-edged razor blade
manila or botany paper
newspaper
flat board, the same size as the manila paper
cement block, books, or a large rock for weight
white glue
plastic wrap
Wonder and Discover Book
Student Page 3.4.13 FLOWERS

PRODUCTS

Flower herbarium sheets
Completed Student Pages

PROCEDURES

1. **Review the major parts of plants and discuss the possible function of flowers with the class.**

   Ask such questions as these:
   - What are the parts of plants?
     ✔ Roots, stems, leaves, flowers, and fruit.

   - Do all plants have all of these parts? Do grasses?
     ✔ No stems.
     Mosses?
     ✔ No stems.
     Mushrooms?
     ✔ No leaves.

- Do most plants have flowers? Can you think of exceptions?
  ✓ This is an opportunity to use the Wonder and Discover Book.

- What do you think the function is of flowers? What makes you think this?
  ✓ Accept all hypotheses.

2. **Introduce the activity of looking closely at flowers and dissecting them to see their smaller parts.**

   Discuss and plan with the students
   - How to get a variety of kinds of flowers.
   - How to get at least four samples of each kind of flower.

3. **Have the students observe their flowers and identify the parts.**

   Have them
   - Cover their working area with paper.
   - Observe the whole flower with and without a hand lens.
   - Draw the undissected flower and identify the parts with numbers on Student Page 3.4.13 FLOWERS.
   - Share their flowers and diagrams with nearby students so that the similarities and differences can be identified.
   - Give names to the common structures. See Figure 3.4.13(1).

4. **Have the students dissect their flowers.**

   Have them
   - Open the pollen case or **anther** of a **stamen**. See Figure 3.4.13(1).
   - Observe with a hand lens.
   - Draw the stamen on their diagram.
   - Share their diagrams so that the similarities and differences can be identified.
   - Give names to the common structures. See Figure 3.4.13 (2).

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- Shake the **pollen** from one flower into the center of another and observe where the pollen sticks.
  ✔ If the students are successful, they will see the pollen stick on the **stigma** at the tip of the **style**. The style is the relatively long column leading down to the ovary. The whole structure is called the **pistil**.
- Locate the **ovary** at the base of the pistil.
- Open the ovary.
- Locate the sack-like structures called the **ovules**.
- Observe these with a hand lens.
- Count the number of ovules.
- Draw the pistil and ovules.
- Share their diagrams with other students so the similarities and differences can be identified.
- Give names to the common structures. See Figure 3.4.13(2).

5. **Discuss observing what happens naturally to the parts of flowers in the garden plants. See Activity 3.4.14 SEEDS.**

6. **Have the students make a herbarium sheet of their flower to show the parts.**

Have them
- Open and cut the flower so that the ovary and other parts are exposed for pressing.
- Label a piece of absorbent manila or botany paper with the name of the plant, the date, and the student's name.
- Place the flower with the parts visible on the paper.
- Cover the flower with several layers of newspaper.
- Stack the herbarium sheets and newspaper.
- Place a board on top of the stack.
- Place a cement block or other heavy weight on top of the board.

- Allow to dry for several weeks.
- Carefully separate the herbarium sheets with the pressed flowers.
- Attach the flower to the paper with a tiny amount of glue if necessary.
- Label the parts.
- Cover the herbarium sheets with plastic wrap or laminate.

EXTENSION

- Have the students assemble a class book of their pressed dissected flowers.

ILLUSTRATIONS

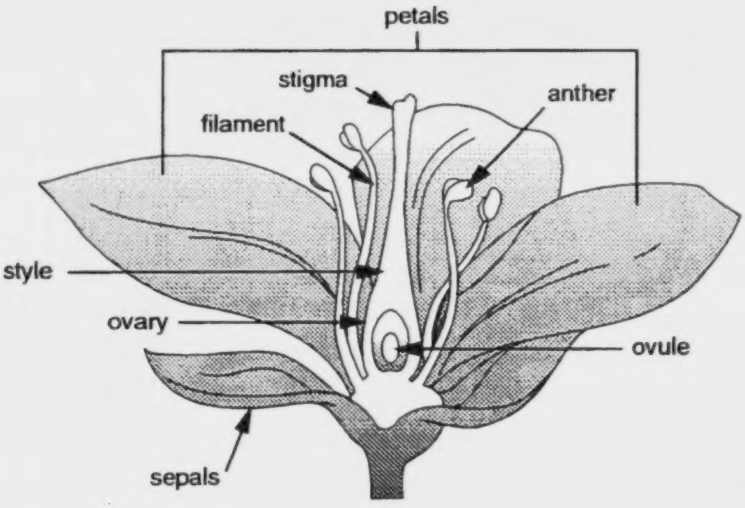
petals
stigma
anther
filament
style
ovary
ovule
sepals

Figure 3.4.13(1) Parts of a flower

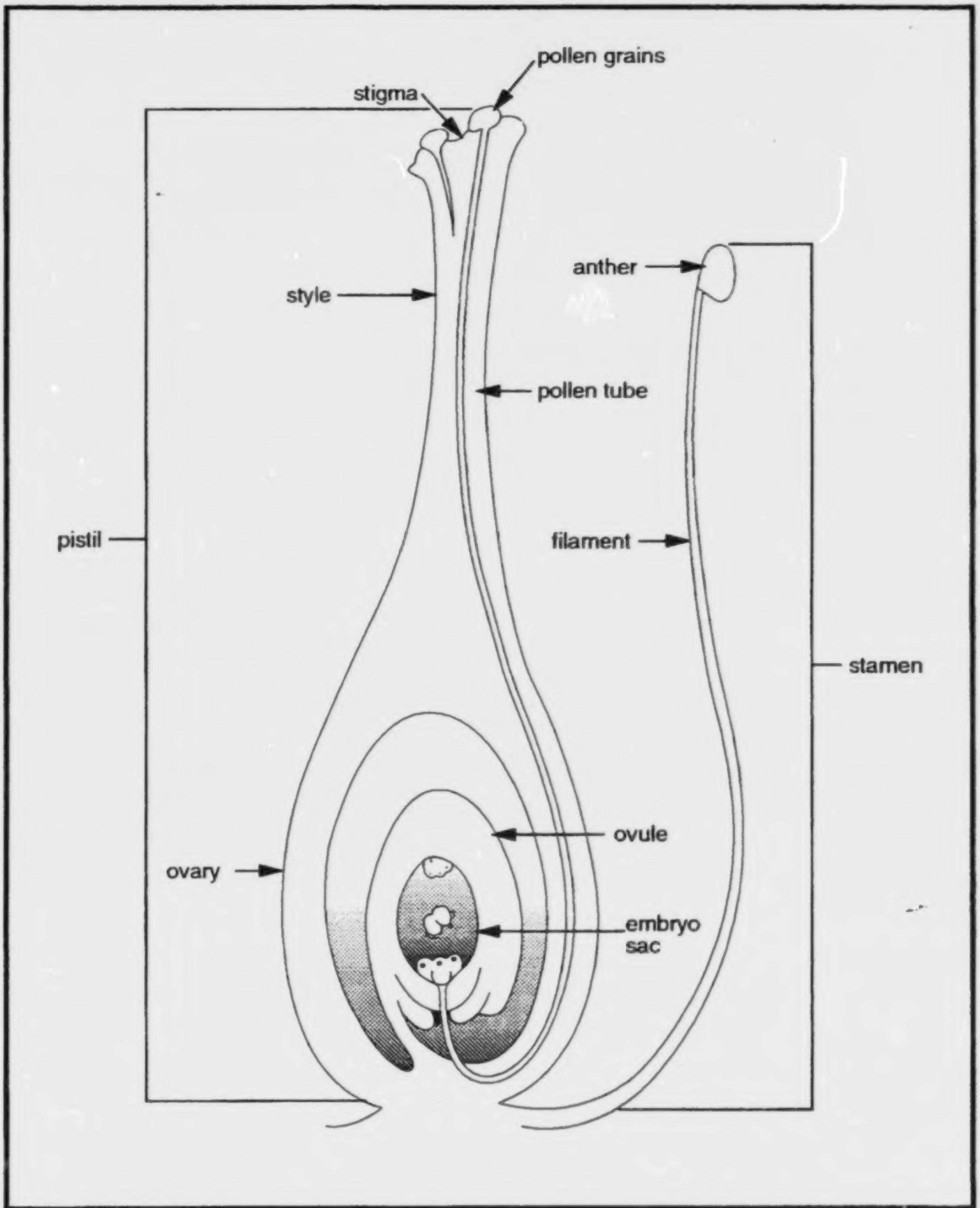
pollen grains
stigma
style
anther
pollen tube
pistil
filament
stamen
ovule
ovary
embryo sac

Figure 3.4.13(2) Flower stamen and pistil

3.4.14 SEEDS

OBJECTIVES

The students
- Dissect a maturing plant ovary each week.
- Identify the developing parts of the ovary.
- Make herbarium sheets showing the developing structures in the ovary.

BACKGROUND

This activity follows Activity 3.4.13 FLOWERS and is done as a part of the gardening sequence. The students dissect maturing ovaries from plants in their garden to observe the development.

A flower or developing ovary from a bean, tomato, or other plant with a large number of flowers is picked and dissected each week by the class. The ovary and its surrounding structures are pressed on a herbarium sheet to record the development from flower to seed. The dissection and pressing techniques introduced in Activity 3.4.13 FLOWERS are used.

STUDENT ROLE

Botanist

MATERIALS

hand lenses
straight pins
Exacto-knife or single-edged razor blade
garden plants with flowers
manila or botany paper
newspaper
flat board, the same size as the manila paper
cement block, books, or large rock for weight
plastic wrap
Completed Student Pages 3.4.13 FLOWERS
Student Page 3.4.14 SEEDS

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PRODUCTS

Seed herbarium sheets
Completed Student Pages

PROCEDURES

1. **When the bean or tomato plants in the garden are just starting to flower, review the observation, dissection, and pressing of flowers from Activity 3.4.13 FLOWERS.**

   Ask such questions as these:
   - What are the parts of flowers?
     ✔ Review Student Page 3.4.13 FLOWERS.
   - What do you think the **ovaries** do in the plant?
   - How could you find out?
     ✔ Work to the idea that they can observe ovaries over time to see what happens to them.

2. **Have the students work in groups to observe the development of seeds. Have them use Student Page 3.4.14 SEEDS.**

   Have them
   - Select a bean, tomato, or other plant with a large number of flowers.
   - Set up a schedule so that a different group dissects and presses one ovary each week.
   - Dissect and observe the ovaries.
   - Share their dissected ovaries for the rest of the class to observe.
   - Press the dissected ovaries to make herbarium sheets. Label them.
     ✔ See Figure 3.4.13(2)

3. **After the plant has fully fruited, summarize the activity with the class.**

   Ask such questions as these:
   - What is the role of the **ovary** in the life of the plant?
   - What does the **ovule** become?
   - Did you find any structures that could have allowed the **sperm** in the pollen grain to enter the **egg** in the ovule? What did this structure look like?
   - Why do you think insects are important in this process of plant **fertilization**?
   - From what part of the flower does the case around the seed seem to develop?

EXTENSIONS

Have the students
- Make a chart of the series of events that result in a mature seed.
- Assemble their herbarium sheets to make a class book on seed development.

3.4.15 POLLINATION

OBJECTIVES

The students
- Identify the female and male organs of corn flowers.
- Protect the immature female organs from pollination.
- Pollinate some female parts and not others.
- Observe development of the pollinated and unpollinated parts.

BACKGROUND

This is the last activity in the plant reproduction sequence. It follows Activity 3.4.14 SEEDS and is an **optional advanced** study to be used to answer questions about pollination. It is best done along with the gardening sequence.

When the corn has grown to the point where ears first appear on the stock, the students cover some with small paper bags. When the tassels produce pollen, the students pollinate the ears in half of the bags but not the others. The students then observe what happens to the pollinated and unpollinated ears.

This activity is possible because corn has a separate pollen-producing tassel and an ovule-producing ear. Pollination experiments can be done on other plants, but the techniques are difficult and would probably require the assistance of a specialist.

STUDENT ROLES

Botanist
Horticulturist

MATERIALS

corn plants
small paper bags
string
hand lenses
Student Page 3.4.15 POLLINATION

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PRODUCT

Completed Student Pages

PROCEDURES

1. **When the corn begins to form ears, review the observation that when pollen is sprinkled over flowers, it sticks to the stigma. Point out that the ears are about to form stigmas. See Activity 3.4.13 FLOWERS.**

   Ask such questions as these:
   - What do you think might happen if the pollen were kept away from the stigmas?
   - Corn has the pollen-generating tassel separated from the stigma and the ovules. How could you keep the pollen away from the stigma on the corn ear?
     ✔ Get at the idea of covering the ears.

2. **Have the students cover the ears on one or two cornstalks with paper bags (six to eight ears). Tie the bags with string to secure them.**

3. **When the tassel shows signs of producing pollen, cut off a ripe one. Have the students remove half the bags and sprinkle pollen over the stigmas which are on the end of the silks. After pollination, have the students cover the ears again and mark the pollinated bags so that they can be identified later.**

   Ask such questions as these:
   - What did the pollen look like?
   - What did the ears look like when you pollinated them?
   - What happened to the pollen when it was sprinkled over the stigma?
   - What do you think will happen to the pollinated ears?
   - What do you think will happen to the unpollinated ears?

4. **After several weeks have the students remove the bags and watch the corn until it reaches maturity. When the corn is harvested, have the students draw pollinated and unpollinated ears on Student Page 3.4.15 POLLINATION.**

   Ask such questions as these:
   - How do the ears look that were pollinated?
   - How do the ears look that were not pollinated?
   - What seems to be the role of pollen?
   - What seems to be necessary for corn to grow to maturity?

5. **Summarize observations and introduce the technical language to the students.**

   Include such terms and ideas as
   - The ovule contains a plant **egg**.
   - Pollen contains the plant **sperm**.
   - Sperm travels from the stigma down the style to the egg in the ovule.
   - Sperm enters the egg, **fertilizing** it.
   - The egg or the ovule can then grow into a seed.

EXTENSION

- Have the students investigate pollination in other plants.

DASH

GARDEN PLANNING SP 3.4.1

Name: ______________________

Date: ______________________

GARDEN TEAM:

TEAM MEMBERS:

Make a list of the things your team is responsible for planning.

DASH

GARDEN PREPARATION
SP 3.4.2

Name: ______________________

Date: ______________________

List all the things that need to be done to prepare the garden plot for planting and put a check by any for which you are responsible.

DASH

GARDEN SOIL OBSERVATION PLAN
SP 3.4.3A

Name: ____________________

Date: ____________________

Draw and label a picture of your system for observing garden soil.

DASH

GARDEN SOIL OBSERVATIONS SP 3.4.3B

Name: ____________________

Date: ____________________

DATE	OBSERVATIONS

DASH

ARTIFICIAL SOIL RECIPE
SP 3.4.4A

Name: ______________________

Date: ______________________

INGREDIENT	PULVERIZING METHOD	AMOUNT	SAMPLE

SP 3.4.4B

DASH

TESTING ARTIFICIAL SOIL
SP 3.4.4B

Name: ____________________

Date: ____________________

WATER TEST

Describe or draw and label pictures showing the steps you used to find out how much water your soil holds.

SOIL		WATER		
KIND	AMOUNT	POURED IN – DRAINED OUT = ABSORBED		
ARTIFICIAL				
NATURAL				

DASH

TESTING SOIL
SP 3.4.5

Name: ______________________

Date: ______________________

DATE	HEIGHT	PLANT OBSERVATIONS	SOIL OBSERVATIONS

SOIL AND WATER EXPERIMENT
SP 3.4.6A

Name: ____________________

Date: ____________________

Describe or draw and label a picture to show how you set up your experiment.

DATE	AMOUNT OF WATER	OBSERVATIONS	
		SOIL	PLANT

DASH

SOIL AND WATER REPORT
SP 3.4.6B

Name: ____________________

Date: ____________________

Describe the class experiment.

Describe your group's part in the experiment.

Describe what you did.

Describe your results.

DASH

GARDEN PLANTING SP 3.4.7

Name: ______________________

Date: ______________________

KIND OF PLANT:

PLANTING DEPTH:

DISTANCE BETWEEN SEEDS:

SUN REQUIREMENTS:

WATER REQUIREMENTS:

SOIL REQUIREMENTS:

AMOUNT OF TIME UNTIL HARVEST:

OTHER NEEDS OR REQUIREMENTS:

DASH

GARDEN CARE
SP 3.4.8

Name: ____________________

Date: ____________________

KIND OF PLANT:
WATER REQUIREMENTS:
THINNING INSTRUCTIONS:
STAKING INSTRUCTIONS:
CULTIVATING INSTRUCTIONS:
OTHER REQUIREMENTS OR INSTRUCTIONS:

GARDEN WATERING SYSTEM
SP 3.4.9

Name: ______________________

Date: ______________________

Draw and label a picture of your design for a garden watering system.

Describe how your system works.

DASH

GARDEN INVADERS
SP 3.4.10

Name: ____________________

Date: ____________________

NAME OF INVADER:

DESCRIBE YOUR PLAN TO GET RID OF THIS GARDEN INVADER.

DASH

INSECT CONTROL
SP 3.4.11

Name: ______________________

Date: ______________________

KIND OF INSECT PEST:		
METHODS OF CONTROL: 1.	2.	
KIND OF PLANT:	NUMBER OF PLANTS:	
DATE	OBSERVATIONS	
	METHOD 1	METHOD 2
How effective was your insect control method? Explain how you decided this.		
What will you do differently next time?		

DASH

GARDEN HARVESTING
SP 3.4.12

Name: ____________________

Date: ____________________

KIND OF FOOD	DESCRIBE HOW YOU WILL KNOW WHEN IT IS READY TO HARVEST	DESCRIBE HOW YOU WILL STORE IT AFTER HARVEST

DASH

FLOWERS
SP 3.4.13

Name: ______________________

Date: ______________________

Draw and label the parts of the flower you dissected.

DASH

SEEDS
SP 3.4.14

Name: ____________________

Date: ____________________

DATE	OBSERVATIONS

DASH

POLLINATION
SP 3.4.15

Name: ______________________

Date: ______________________

Draw a pollinated ear of corn.	Draw an unpollinated ear of corn.

DASH

GRADE THREE
CLUSTER 5

FOOD AND NUTRITION

3.5.1 Food Selection
3.5.2 Selecting Plants for the Garden
3.5.3 Planning the Class Feast
3.5.4 Preparing the Class Feast
3.5.5 The Class Feast
3.5.6 Drying Foods
3.5.7 Pickling Foods
3.5.8 Preserving and Rotting
3.5.9 Supermarket Game Preparation
3.5.10 Pricing Foods
3.5.11 Newspaper Ads and Banking
3.5.12 Farmers and Processors
3.5.13 Supermarket Game

3.5.1 FOOD SELECTION

OBJECTIVES

The students
- Review the Activation, Regulation, and Fabrication (ARF) System of classifying foods according to the way the body uses them.
- Determine how many servings of each of the three food groups they need to serve their family for one day.
- Make a shopping list based on a budget.
- Purchase needed items at the class supermarket.
- Calculate the amount of food left over from one day's meals.

BACKGROUND

This activity is used with three activity sequences—the Class Supermarket, the Class Garden, and the Class Feast. If the gardening and feast activities are done before the supermarket activities, complete this activity through Procedure 2. Then proceed to Activity 3.5.2 SELECTING PLANTS FOR THE GARDEN. If the supermarket sequence comes first, complete this entire activity after Activity 3.5.12.

The students begin with a review of the ARF system for classifying foods. In this system foods are classified by the way the body uses them—for **activation**, **regulation**, and **fabrication**.

After the review of the ARF system, the size of servings and the number of servings needed by a person each day are introduced. This information gives the students a tool for selecting the food to be purchased by the Consumer Group during the Supermarket Game. Student Page 3.5.1A FOOD SELECTION gives them information on how much food constitutes a serving. Other information is provided through music, rhymes, aphorisms, and charts. An additional list of foods and their serving sizes can be found in the World Almanac under the heading "Nutritive Values." Serving size is found in the "measure" column.

Serving size information is used in three ways. The students plan menus for their at-home families, for their team families when they

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are the Consumers during the Supermarket Game, and for their Class Feast.

As a first activity, the students are given a food budget for planning their at-home family's meals for one day. A realistic amount based on what is generally spent per person per day for food by families in the class should be used. Generally this will range from $3.00 to $10.00 per person multiplied by the number of people in each student's family.

In the Supermarket Game the Consumer Group is given a similar budget for its team families. The students make a menu plan for a day and a shopping list from the foods available in the Class Supermarket. When the Supermarket Group publishes its special food ads, encourage the students to use the ads to get the best value for their money.

Do not be concerned with the varying amounts of foods in serving sizes shown on Student Page 3.5.1A FOOD SELECTION. Arriving at precise serving sizes is too complex for grade 3 students. Determining serving size involves knowing the density of foods and their nutritional content, two concepts not yet developed. For these activities simply present the information as shown. For further information on foods not found on the student pages, see Figure 3.5.1(7) Suggested Serving Sizes.

STUDENT ROLES

Consumer
Householder

MATERIALS

assorted food containers
measuring cups
measuring spoons
balances (See Activity 3.10.12 MEASURING DEVICES.)
baby-food jars
volume jars (See Activity 3.10.12 MEASURING DEVICES.)
class supermarket
special ads for the class supermarket
Student Pages 3.5.1A FOOD SELECTION
3.5.1B FOOD SERVINGS
3.5.1C SHOPPING LIST
3.5.1D LEFTOVERS

PRODUCT

Completed Student Pages

PROCEDURES

1. **Review the ARF System for grouping foods with the class using the ARF FOOD GROUP RHYME, the ARF NUTRITION WHEEL, and the ARF FOOD GROUP SONG. See Figures 3.5.1(1–3).**

2. **Have the students use the ARF NUTRITION WHEEL (Figure 3.5.1(3)) to identify the ARF food groups on pages 1–4 of Student Page 3.5.1A FOOD SELECTION.**

   Have the students
   - Use the ARF Nutrition Wheel to identify the ARF groups listed on Student Page 3.5.1A FOOD SELECTION.

   - Compare their lists and agree on which foods belong to multiple ARF groups.

3. **Introduce the idea of serving size to the students by discussing the information on Student Page 3.5.1A FOOD SELECTION.**

   Have the students
   - Fill food cans of various sizes with water to measure and compare their volume.
     ✔ See Activity 3.10.12 MEASURING DEVICES.

   - Find the serving sizes given on canned, frozen, and other packaged foods.

   - Note that a serving of meat is usually 3 oz or 85 g.

   - Discuss the need for a wide variety of foods to get all the nutrients the body needs.

4. **Have the students discuss the number of servings of each ARF food group that should be eaten each day. Use the ARF APHORISM (Figure 3.5.1(4)) and the top of Student Page 3.5.1B FOOD SERVINGS to introduce this information.**

Ask such questions as these:

- Why do you think that the number of servings of **fabrication** foods suggested varies from 4 to 6 while the number of servings suggested for **activation** and **regulation** does not?
  ✔ Get at the idea that some people may need more food than others to build and repair their bodies.

- When do people need more food?
  ✔ Get at the idea that when they are growing or doing hard work, people have to rebuild their bodies.

- How many servings of food do you think we need at each meal?
  ✔ Get at the fact that many of us eat more at dinner and lunch than at breakfast.

- How many servings of each food group do we get in our school lunch?
  ✔ School lunch usually provides at least 1/3 of the daily recommended nutrition requirements for a child.

5. **Have the students make menus for their own (at-home) families.**

Have the students discuss

- Making a menu on Student Page 3.5.1B of the food needed for breakfast, lunch, and dinner.

- Using the ARF Food Groups to be sure they have planned nutritious meals.

- Using the needs of their own at-home families.

- Considering the food likes and dislikes of their family members.

6. **Before the Supermarket Game, discuss the need to make a menu and a shopping list in order to purchase food wisely from the Class Supermarket.**

Have the students discuss

- Making a menu on Student Page 3.5.1B of the food needed for breakfast, lunch, and dinner.

- Using the ARF Food Groups to be sure they have planned nutritious meals.

- Considering the needs of their team families.
- Considering the food likes and dislikes of their team's family members.
- Getting as economical a selection of foods as they can by using the food ads for the Class Supermarket.
  ✓ See Activity 3.5.11 FOOD ADS AND BANKING.

7. **Before or during the Supermarket Game, have the students make a menu for one day's meals for their team family.**

   Have them
   - Use Student Page 3.5.1B FOOD SERVINGS to plan for a day.
   - Determine how many servings of food are needed for their team family each day.
   - Decide what food to buy.
   - Decide how many servings of each food to buy.

8. **During each round of the Supermarket Game, have the Consumer Group calculate how much food it needs and its cost on Student Page 3.5.1C SHOPPING LIST using its assigned food budget, the Supermarket Price List, and Sale Ads.**

   Have them
   - Find the cost of each item on the list.
   - Calculate the total cost of the list.
   - Revise the list to stay within the budget.

9. **Have the Consumer Group go to the Class Supermarket and make its purchases. If a food listed is unavailable, have the group make a substitution, taking into consideration the food group and the cost.**

10. **Have the students match the number of servings of each ARF food group in the containers they have purchased with the number of servings their family needs. Use Student Page 3.5.1D LEFTOVERS to calculate the amount of leftover food.**

11. **After all the rounds of the game have been played, summarize the activity with the class.**

Ask such questions as these:

- Did the Supermarket have all of the things you wanted to buy?
- What kinds of substitutes did you have to make?
- How did this change your menu?
- Did the substitute foods cost more or less?
- What could you plan to do with your leftover foods?
- What would you do differently the next time you need to buy food?

EXTENSION

- Have the students take extra copies of the Student Pages home to plan menus and shopping lists with their families.

ILLUSTRATIONS

THE ARF FOOD GROUP RHYME

Grains and butter, a sesame seed roll,
Potato and sugar, cereal in a bowl.

These are foods for **activation**.

For crawling and climbing, getting all hot,
For running and jumping, turning on a dot.

Making bodies move is **activation**.

Spinach and cauliflower, corn on the cob,
Apples and oranges, pureed peaches in a glob.

These are foods for **regulation**.

For digesting and defending, controlling things inside,
For seeing and thinking, directing what's supplied.

Making bodies work is **regulation**.

Steak and beans, roasted chicken legs,
Milk and codfish, ham served with eggs.

These are foods of **fabrication**.

For building and maintaining, making muscles strong,
For repairing and growing, making bone that's long.

Making bodies grow is **fabrication**.

Figure 3.5.1(1) The ARF Food Group Rhyme

THE ARF FOOD GROUP SONG

Activation, activation,
Makes me move, groove and move.
Potatoes, rice, and shredded wheat,
Butter, bread, and candy sweet,
Activation foods,
Activation foods.

Regulation, regulation,
Makes me work, perk and work.
Spinach, corn, and cauliflower,
Apples, raisins, fiber power.
Regulation foods,
Regulation foods.

Fabrication, fabrication,
Makes me grow, repair and grow.
Beans, chops, and turkey legs,
Milk, fish, steak, and eggs,
Fabrication foods,
Fabrication foods.

(Sing to the tune of "Are You Sleeping?")

Figure 3.5.1(2) The ARF Food Group Song

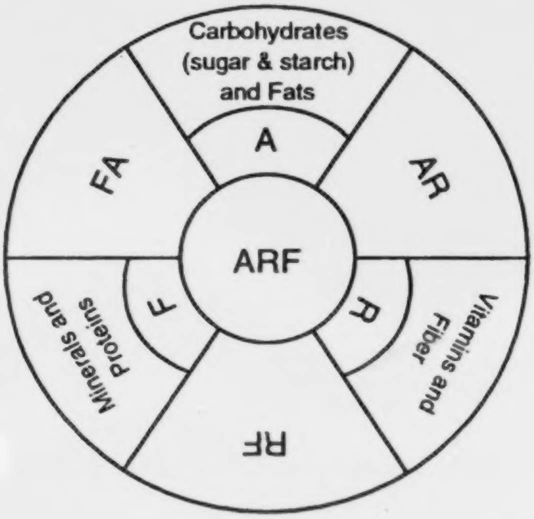
Carbohydrates
(sugar & starch)
and Fats
A
FA
AR
ARF
F
Proteins
Minerals and
R
Vitamins and
Fiber
RF

Figure 3.5.1(3) The ARF Nutrition Wheel

ARF APHORISM

Eat the group of three
In wide variety.
When selecting foods in the right amounts,
Remember the ARF serving counts.
We need 4 servings of A and 4 of R,
And 4–6 of F to be up to par.

Figure 3.5.1(4) ARF Aphorism

MEASUREMENT EQUIVALENTS

1 teaspoon	1/3	tablespoon	1/6	fl oz*	.005	liter	5	grams
1 tablespoon	3	teaspoons	1/2	fl oz	.015	liter	14	grams
4 tablespoons	1/4	cup	1/8	lb (2 fl oz)	.06	liter	57	grams
1 cup	1/2	pint	1/2	lb (8 fl oz)	.24	liter	228	grams
2 cups	1	pint	1	lb	.47	liter	454	grams
2 pints	1	quart**	2	lb	.94	liter	908	grams

* Food usually weighs about the same as an equal volume of water. One (1) pint of water weighs about 1 pound. One (1) pint of processed food such as vegetables and fruits packed in cans or frozen packaged foods, weighs about 1 pound.

** For estimating volumes, 1 quart is about equal to a liter.

Figure 3.5.1(5) Measurement Equivalents

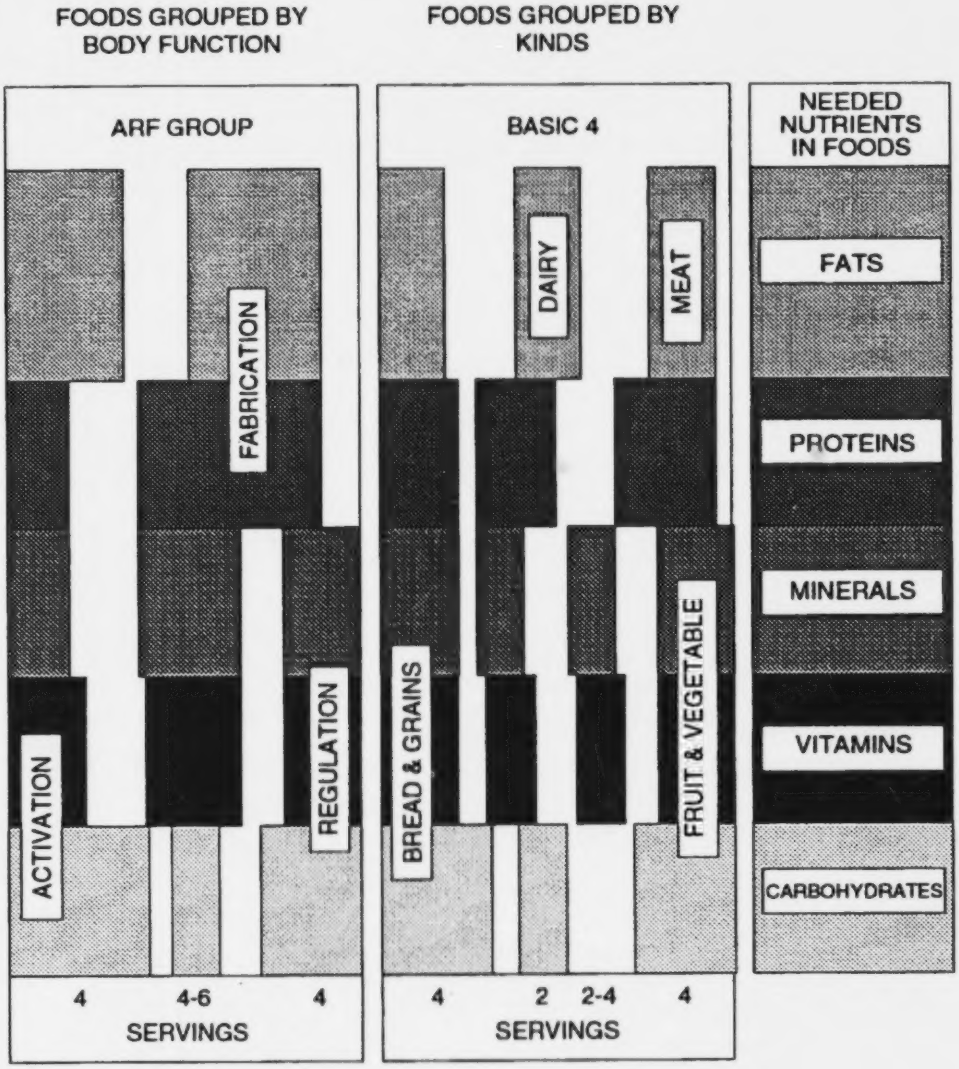
FOODS GROUPED BY BODY FUNCTION
FOODS GROUPED BY KINDS
ARF GROUP
BASIC 4
NEEDED NUTRIENTS IN FOODS
ACTIVATION
FABRICATION
REGULATION
BREAD & GRAINS
DAIRY
MEAT
FRUIT & VEGETABLE
FATS
PROTEINS
MINERALS
VITAMINS
CARBOHYDRATES
4
4-6
4
SERVINGS
4
2
2-4
4
SERVINGS

Figure 3.5.1 (6) Food Groups and Nutrients

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ONE SERVING					
	CUPS	OUNCES	PIECE	LITERS	GRAMS
CANNED VEGETABLES	1/2			1/8	
FRESH VEGETABLES	1/2			1/8	
CANNED FRUIT	1/2			1/8	
FRESH FRUIT			1		
MEAT		3			85
CHICKEN		3			85
FISH		3			85
DRINKS	1			1/4	
PASTRIES			1		
BREADS			1		
PASTA	1			1/4	

Figure 3.5.1(7) Suggested Serving Sizes

3.5.2 SELECTING PLANTS FOR THE GARDEN

OBJECTIVES

The students
- Select foods to be grown in the class garden.
- Select foods for the garden according to the way the body uses them.
- Determine the growing requirements of food plants.

BACKGROUND

This activity is done in connection with Activity 3.4.1 GARDEN PLANNING. The garden sequence leads to Activity 3.5.5 THE CLASS FEAST. The students will need to use the information on the Student Pages from Activity 3.5.1 FOOD SELECTION.

Using DASH's Activation, Regulation, and Fabrication (ARF) System of classifying foods, the students make concept maps or lists of plants that they think can be grown in the garden to supply a nutritious variety of foods. They determine the growing requirements for these plants by studying the information on the seed packages. The students select the plants to be grown in their garden and plan their planting schedule so all the plants are ready for harvest when they have their Class Feast.

STUDENT ROLES

Gardener
Planner
Horticulturist

MATERIALS

chart paper
markers
seed packages
Student Pages 3.5.1 FOOD SELECTION
3.5.2 GARDEN FOOD PLANTS

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PRODUCTS

Class list of plants and food groups
Class list of garden food plants
Completed Student Pages

PROCEDURES

1. **Have the students make lists of plants in each food group.**

   Ask such questions as these:
   - What are some plants that produce **activation** foods?
   - What are some plants that produce **regulation** foods?
   - What are some plants that produce **fabrication** foods?
   - Are there any plants that fit into more than one group? Which ones?

2. **Have the class discuss the idea of planning the garden to produce the foods for the class feast.**

   Ask such questions as these:
   - Where did you record information about the nutritional value of foods?
     ✔Work toward using the information on the student pages from Activity 3.5.1 FOOD SELECTION.
   - Where could you find information about growing food plants?
     ✔ The backs of seed packets usually have this information.

3. **Have the students work in groups to select the food plants to grow in their garden.**

   Have them
   - Use the student pages from Activity 3.5.1 FOOD SELECTION.
   - Include a variety of foods from each of the ARF food groups.
   - Make a Class List of the food plants they will grow.

4. **Have the students do research on the plants they selected to grow in their garden.**

Ask such questions as these:

- How long does it take the plants to grow until they are ready to harvest and eat?
- What growing conditions do the plants need?
- At what time of the year can the plants be grown?
- What space requirements or other needs do the plants have?

5. **Have the students record their findings on Student Page 3.5.2 GARDEN FOOD PLANTS. Have them use this information in Activity 3.4.1 GARDEN PLANNING.**

EXTENSION

- Have the students use seed catalogs, gardening books, and brochures from the local Agricultural Extension Service to do additional research on the food plants for their garden.

3.5.3 PLANNING THE CLASS FEAST

OBJECTIVES

The students
- Plan for their class feast.
- Plan to include a wide variety of vegetable dishes in their feast.

BACKGROUND

This activity follows Activities 3.5.1 FOOD SELECTION (Procedures 1 and 2), 3.5.2 SELECTING PLANTS FOR THE GARDEN, 3.4.1 GARDEN PLANNING, and 3.4.2 GARDEN PREPARATION. The feast is used to bring closure to the gardening experience. The class works together to plan all aspects of their Class Feast.

Plan for the feast at least a month before the event so that invitations and other arrangements can be made. Whenever possible have the students suggest ways to solve any problems arising from the feast.

The students first invent a reason for having the feast and discuss the guest list. The feast can serve such purposes as providing a family-school activity or celebrating a holiday. The students decide where and when the feast will be held. They need to consider school limitations and work within these as any banquet planner would. The class should plan a menu for the feast that provides a wide variety of individual tastes. Plans should include where the preparation of food will be done. This will in part be determined by parental involvement. Food can be prepared at home or at school. If the garden does not supply enough food, additional fruits and vegetables can be purchased. Collection of cooking equipment, condiments, and other basic cooking ingredients needs to be included in the planning. Have the students consider the problem of funding. They might sell tickets to the feast. They should plan for entertainment, speeches, recognitions, and presentations.

STUDENT ROLES

Caterer
Banquet planner

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MATERIALS

chart paper
markers
Student Page 3.5.3 CLASS FEAST PLAN

PRODUCTS

Class feast plans
Class feast menu
Responsibility chart for class feast
Planning time line or calendar
Completed Student Pages

PROCEDURES

1. **Have the class discuss the need for planning for their Class Feast.**

   Help them include such ideas as
   - The reason for the feast.
   - Who should attend.
   - Where the feast is to be held.
   - When the feast is to be held.
   - Where the preparation is to be done.
   - How supplies are to be secured.
   - How cleanup is to be organized.
   - How any financing will be done.
   - Entertainment and other formalities.

2. **Have student groups do the planning for each part of the feast using Student Page 3.5.3 CLASS FEAST PLAN. Have them share their ideas with the class and modify their plans as necessary.**

Help the students include such things as
- Site and date selection.
- Invitations.
- Supplies.
- Preparation.
- Cleanup.
- Finance.
- Entertainment.

3. **Have the students collect recipes for the Class Feast. Have the class select a menu for the feast.**

Have them include
- What foods they will prepare.
- Foods from all the food groups.
  ✔ See Activity 3.5.1 FOOD SELECTION.
- How they are going to prepare the food from their garden.
- What additional supplies they will need.

4. **Have the class make a Class Feast Responsibility Chart. Have them make a planning time line or calendar with check-off spaces to show when each job is completed.**

EXTENSIONS

Have the students
- Invite older students who worked on Class Feasts in previous years to advise the planning groups.
- Combine the efforts of several classes into a School Feast.
- Plan the Class Feast around ethnic dishes, family favorite dishes, or some other food-related theme.

3.5.4 PREPARING THE CLASS FEAST

OBJECTIVES

The students
- Adjust recipes to provide the number of servings needed for the feast.
- Prepare foods for their Class Feast.
- Use vegetables and fruits grown in their garden.
- Review safety and sanitation practices for food preparation.

BACKGROUND

This activity follows Activity 3.5.3 PLANNING THE CLASS FEAST. The students prepare a wide variety of vegetable dishes. The idea that nutritional needs can be satisfied with vegetable matter is reviewed.

The students carry out their plans for preparing vegetable dishes for the class feast. They adjust recipes so that they will be adequate to serve everyone attending the feast. The students also review sanitation and safety practices. This activity provides an opportunity to invent some appropriate aphorisms. (See Activity 3.1.10 APHORISMS.)

STUDENT ROLES

Chef
Mathematician

MATERIALS

recipes
foods as determined by the class feast menu and recipes
cooking and food preparation equipment
eating utensils
Student Page 3.5.4 CLASS FEAST RECIPE

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PRODUCTS

Recipes
Prepared foods
Completed Student Pages

PROCEDURES

1. **Have the students determine the amount of each dish that will be required for the Class Feast.**

   Have them
   - Determine the number of persons to be served.
   - Collect the recipes needed to prepare the foods on their Class Feast menu.
     ✔ See Activity 3.5.3 PLANNING THE CLASS FEAST.
   - Determine the number of servings that will be eaten.
   - Work in groups to determine how much of each dish should be prepared.
   - Work in groups to adjust the proportions of the ingredients and cooking times for each recipe.
   - Record their revised recipes on SP 3.5.4 CLASS FEAST RECIPE.

2. **Have the students review sanitation and safety rules.**

   Have them discuss
   - Sanitation practices for washing hands.
   - Sanitation practices for washing produce.
   - Sanitation practices for washing equipment before preparing food.
   - Sanitation practices for washing tables and food preparation surfaces.
   - Sanitation practices for washing utensils and dishes after the feast.

- Sanitation practices for garbage disposal.
  ✔ See Activity 3.9.1 MAKING COMPOST.
- Refrigeration of foods that will not be served immediately.
- Safe use of peeling and cutting tools.
- Safe transportation of hot dishes and pots.
- Other safety and sanitation practices as appropriate.

3. **Have student groups prepare the foods for their Class Feast.**

4. **Have the students prepare the eating area for the Class Feast.**

EXTENSIONS

Have the students

- Discuss size and serving information with the school cafeteria people or a caterer.
- Make a Class Cookbook of the recipes for their Class Feast.
- Invent new aphorisms for sanitation and safety rules.

3.5.5 THE CLASS FEAST

OBJECTIVES

The students
- Carry out their plans for the Class Feast.
- Discuss the success of their Class Feast.

BACKGROUND

This activity is the culminating activity of the gardening sequence. Wherever possible activities should be carried out by the appropriate student groups. This activity carries out the students' plan for their Class Feast.

STUDENT ROLES

Banquet worker
Entertainer

MATERIALS

Prepared foods from Activity 3.5.4 PREPARING THE CLASS FEAST
Other items as required by the class feast plan (See Activity 3.5.3. PLANNING THE CLASS FEAST.)
Student Page 3.5.5 CLASS FEAST SUMMARY

PRODUCTS

Class feast
Completed Student Pages

PROCEDURES

1. **Have the students carry out their plans for their Class Feast.**

   Include such things as
   - Room setup

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- Entertainment
- Serving
- Cleanup

2. **Have the students plan and carry out feast follow-up activities.**

   Include such things as
   - Thank-you letters for help received.
   - Distribution of leftovers.
   - Return of borrowed equipment.

3. **Have the student groups report on the success of their part in the Class Feast. Use Student Page 3.5.5 CLASS FEAST SUMMARY. Have the class discuss the activity.**

   Ask such questions as these:
   - What went well?
   - What might we do differently next time?
   - What did we learn?

EXTENSION

- Keep the group reports to be used to help plan for next year's Class Feast.

3.5.6 DRYING FOODS

OBJECTIVES

The students
- Invent ways to dry seeds from garden plants.
- Invent ways to dry fruits and vegetables.

BACKGROUND

DASH students have been investigating the process of decomposition of once-living (organic) and never-living (inorganic) materials since kindergarten. Each year they have also done a gardening project. In this activity and in Activity 3.5.7 PICKLING FOODS, the students study two ways that foods grown in their garden can be preserved. This preservation theme will be revisited in grade 6 when a comprehensive study of bacterial and mold infection and food preservation is undertaken. Activity 3.5.8 PRESERVING AND ROTTING completes the grade 3 food preservation sequence.

Drying is the primary way of preserving seeds for food or for later planting. Beans, peas, wheat, rice, and corn are examples of seeds that are dried and later used for food. All seeds from the class garden that are not used for food should be dried and saved for next year's garden. Seeds should first be cleaned so that no pulpy matter is left attached. They will then dry easily in the sun or in dry areas of the classroom without molding. The seeds' coats protect them from mold infection.

Drying is also used to preserve some fruits and vegetables. In this activity, garden fruits and vegetables are dried. Grapes, plums, and other foods can also be included as desired. Drying foods should be covered with cheesecloth or fine screen to keep insects away.

This activity is exploratory and functional. The students should be encouraged to slice foods to increase the evaporation area, leave some foods whole, leave some foods with their skin on, remove the skin of others, and freely explore other ideas.

One way to dry fruit is to place a single layer of whole or sliced fruit in a shallow or flat container lined with foil or plastic wrap. The

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container should be covered with cheesecloth or fine screening and placed in a dry, windy area. Turn the fruit once a day.

The primary organism to attack fruits and vegetables is mold which can be controlled by careful washing. Help the students review sanitation practices including washing hands, equipment, and food.

STUDENT ROLES

Inventor
Seed producer
Food dryer

MATERIALS

samples of corn, beans, and other seed foods
cheesecloth or fine screen
flat trays or shallow cardboard boxes or lids
plastic wrap or foil
small plastic bags
knives
peelers
garden fruits and vegetables
other fruits and vegetables as desired
soap and water
Student Page 3.5.6 DRYING FOODS

PRODUCTS

Dried seeds
Dried fruits
Dried vegetables
Completed Student Pages

PROCEDURES

1. **Have the students make a class concept map about food preservation.**

   Help the students include such things as
   - Different ways that food can be preserved.
     ✔ Drying, canning, smoking, salting, refrigerating, pickling, etc.

   - Different foods that can be preserved.

- How food preservation processes are done.

2. Discuss preserving seeds and foods for later use.

Ask such questions as these:
- Why would you want to preserve the seeds from plants?
  ✔ Work toward the ideas of planting next year's garden and using the seed for food. Show some samples of seed foods if necessary.

- How are seed foods kept from rotting?
  ✔ Work toward the idea of drying them.

- How do you think seed foods are preserved in nature?
  ✔ Work toward the idea of drying in the sun.

- How might you dry them?

3. Have student groups invent ways of drying seeds, fruits, and vegetables.

Have them
- Review sanitation practices.
  ✔ Get at the idea of washing fruits, vegetables, hands, and equipment.

- Invent ways to keep flies and other insects away.

- Test their processes.

- Use SP 3.5.6 DRYING FOODS to record their ideas.

4. Have the students taste their fruits and vegetables immediately after they are dried and one week later. Have them compare the similarities and differences.

5. Have the class discuss ways to prevent seeds, fruits, and vegetables from rehydrating once they are dried.

Have them
- Invent ways to store dried seeds, fruits, and vegetables.

- Store their dried plant materials.

EXTENSIONS

Have the students

- Visit a commercial food-dehydration plant.
- Invite parents to share methods they use to dehydrate foods.
- Research other dehydration processes used with foods.

3.5.7 PICKLING FOODS

OBJECTIVES

The students
- Make a concept map about food preservation.
- Pickle foods from their garden.

BACKGROUND

This activity is the second in the series on preserving foods grown in the class garden. Pickling is a common way of preserving vegetables such as cucumbers, cauliflower, and carrots. It involves soaking the vegetables in brine (a strong solution of non-iodized salt and water) and then heating them for a short time in vinegar and water. Since both brine and vinegar retard bacterial and mold growth, pickled foods resist decomposition for long periods of time.

The students are encouraged to collect pickling recipes. Recipes can be found in many cookbooks. Several recipes for pickling vegetables are included at the end of this activity.

STUDENT ROLE

Food preserver

MATERIALS

chart paper
markers
examples of pickled food
pH paper
cobalt chloride paper
small plastic bags
knives
peelers
garden fruits and vegetables
salt
vinegar
other ingredients as required by the recipe

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canning jars with lids
cooking pots
soap
water
Student Page 3.5.7 PICKLING FOODS

PRODUCTS

Concept map about food preservation
Class list of pickling ingredients
Pickled foods
Completed Student Pages

PROCEDURES

1. **Have the students review and revise their concept map about food preservation from Activity 3.5.6 DRYING FOODS.**

2. **Introduce the class to pickled foods. Use some examples.**

   Have them
   - Taste the foods.
   - Discuss what ingredients might be used in the pickling process.
   - Record their ideas on a class list.
   - Test the pH of pickles.
   - Use cobalt chloride paper to test the pickles for the presence of water.

3. **Have the students plan to make pickles.**

   Have them
   - Collect pickling recipes.
   - Validate their ideas about ingredients from Procedure 2.

4. **Have student groups pickle different kinds of foods.**

   Have them
   - Organize groups to make pickled foods.

- Use foods from the class garden if possible.
- Make pickled foods following their recipes.
- Observe and taste their pickled foods immediately after they are made, one week later, and at the end of the year.
- Record their findings on Student Page 3.5.7 PICKLING FOODS.

5. **Summarize the activity by having the groups report on how their pickles changed during the observation period.**

EXTENSIONS

Have the students
- Visit a commercial pickling plant.
- Invite parents to share methods they use to pickle foods.
- Investigate other pickling processes used with foods.
- Make a pickling cookbook.
- Investigate other ways of preserving foods.

PICKLING RECIPES

Hints for Successful Pickles

If possible use fresh produce not over 24 hours old. To accumulate enough cucumbers for a recipe, pick the cucumbers daily and hold for future use in a strong brine solution. When picking the cucumbers, leave on 1/4 to 1/2 inch of the stem. Wash thoroughly but do not remove the prickles from the skin. Place the clean cucumbers in a brine solution made of 1 cup non-iodized or pickling salt dissolved in 5 cups of water. When it is time to make pickles, remove the cucumbers from the brine and soak them in cold water to freshen.

If a recipe calls for vinegar, use clear or cider vinegar, 4–6% acetic acid. Use glass, pottery, or enamel containers (not metal) to prepare pickles. Keep pickles completely under the brine or vinegar mixture.

Dill Pickles

Glass containers with lids
50 4-inch cucumbers
1 medium bunch dill
1/2 small horseradish root, diced
Brine
    5 quarts water
    1/2 cup salt
    3/8 cup cider vinegar

Wash cucumbers. Soak overnight in salt and water (1 cup salt to 4 quarts water). Drain and dry. Layer cucumbers into sterilized jars with dill and horseradish. Boil brine and pour over pickles. Seal immediately.

Fresh Pickled Vegetables

Glass or enamel bowl
2 dozen medium-sized radishes
  or 2 small cucumbers
  or 4 medium carrots
Salt
Vinegar sauce:
  1/3 cup cider vinegar
  1 teaspoon salt
  4 tablespoons sugar
  1/2 teaspoon monosodium glutamate (optional)

Wash radishes or cucumbers. Slice very thin. Sprinkle lightly with salt. Let stand for 10 minutes. Drain the vegetables thoroughly. Soak them in the vinegar sauce for several hours or overnight. If using cucumbers, peel off the skin leaving a few green strips. Slice and remove the seeds.

Variations: Try other vegetables.
Add some green bell pepper or a small, finely slivered piece of ginger.

Sweet Pickles

Glass, pottery or enamel containers with lids
50 large cucumbers
3 quarts water
1/2 cup salt
1 medium bunch dill
1 onion
Syrup
  4 cups sugar
  2 cups cider vinegar

Wash and drain cucumbers. Mix the salt and water and bring to a boil to make the brine. Pour over cucumbers. Add dill. Let stand overnight. Drain and dry. Slice cucumbers into one-inch pieces. Put into glass jars with 2 slices of onion per jar. Boil vinegar and sugar to make a syrup. Cool. Pour over pickles and seal.

DASH 3.5.8 PRESERVING AND ROTTING

OBJECTIVES

The students
- Design and carry out an experiment to see whether dried seeds, dried fruits, dried vegetables, and pickled foods rot.
- Use experimental and control samples.

BACKGROUND

In this activity the students broaden their investigation of the decomposition process to include preserved foods. This activity follows Activity 3.5.6 DRYING FOODS and Activity 3.5.7 PICKLING FOODS. The students compare the rate of decomposition of dried, pickled, and unpreserved foods.

The students are introduced to the technical terms **experimental sample** and **control sample**. The preserved seeds and foods are the experimental samples and the unpreserved seeds and foods are the control samples.

Use caution when opening the samples. Some students may be allergic to molds. To check samples for odor, open the container away from the face and use one hand to waft the air from the open container toward the nose.

STUDENT ROLE

Agricultural researcher

MATERIALS

samples of dried seeds
samples of undried seeds
samples of dried fruits and vegetables
samples of undried fruits and vegetables
samples of pickled foods
samples of unpickled foods
heavy-weight, sealable plastic bags

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large thumbtacks or pushpins
glass pickling jars and lids
soap and water
Student Pages 3.5.8A PRESERVING AND ROTTING: PREDICTIONS AND PLANNING
3.5.8B PRESERVING AND ROTTING: OBSERVATIONS

PRODUCT

Completed Student Pages

PROCEDURES

1. **Have the class discuss their attempts to preserve seeds and other foods and ways to see how effective their efforts have been.**

   Ask such questions as these:
   - How could you observe whether you have been successful in preserving the seeds and foods you dried and pickled?
     ✓ Work toward the idea that they need to find out how well the foods and seeds they have processed have been preserved compared to unpreserved foods and seeds.
   - How can you get information on seeds and other foods that have been preserved?
     ✓ Help the students see that the preserved foods are already in storage containers that can be watched. They need to put unpreserved seeds and food in separate containers.
   - What could you call the food that is preserved and the food that is not preserved?
     ✓ Introduce the terms **experimental sample** and **control sample**.

2. **Have the class organize the preserving and rotting experiment.**

   Have them
   - Plan the class experiment.
   - Decide on a time limit for the experiment.
   - Organize teams.

- Set up a responsibility chart for observing.
- Make their own hypotheses to predict what will happen to each of the foods.
- Carry out the experiment and make observations.
- Use Student Page 3.5.8A PRESERVING AND ROTTING: PREDICTIONS AND PLANNING and Student Page 3.5.8B PRESERVING AND ROTTING: OBSERVATIONS.

3. Summarize the experiment observations with the class.

Have the students
- Give group reports on their observations.
- Decide whether to terminate the experiment and open the containers to test for odors.
  ✔ See Extension.
- Interpret their data.
- Discuss the success of their hypotheses.

EXTENSION

- Continue the experiment over the summer, passing it on to the grade 4 teacher.

3.5.9 SUPERMARKET GAME PREPARATION

OBJECTIVES

The students
- Organize to play a supermarket simulation game.
- Identify and discuss the components of a complex supermarket system.

BACKGROUND

This activity introduces the supermarket sequence. It should be followed by Activities 3.10.10 SUPERMARKET PLANNING, 3.10.11 SUPERMARKET CONSTRUCTION, 3.5.10 PRICING FOODS, 3.5.11 NEWSPAPER ADS AND BANKING, 3.5.12 FARMERS AND PROCESSORS, 3.5.1 FOOD SELECTION, and 3.5.13 SUPERMARKET GAME.

In this activity the game responsibilities of the Farm, Food Processor, Supermarket, Newspaper, Bank, and Consumer Groups are identified. Student teams carry out the responsibilities of the six groups. The students should develop their own set of responsibilities for each group. A suggested model follows to help facilitate the discussion.

The Farm Group

1	Manager
2–3	Independent farmers
1	Quality control expert

Responsibilities include
- Receiving food orders from the Food Processor Group.
- Growing food by making Food Cards. (See Student Page 3.5.12A FOOD CARDS.)
- Checking food quality.
- Delivering the food to the Food Processor Group.

The Food Processor Group

1	Manager
2–3	Packers
1	Quality control expert

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Responsibilities include
- Receiving recycled cans and cardboard containers from the Consumer Group.
- Making additional food containers and labels as needed.
- Receiving orders from the Supermarket Group.
- Ordering food from the Farm Group.
- Receiving food in the form of Food Cards. (See Student Page 3.5.12A FOOD CARDS.)
- Cutting out Serving Portion Slips. (See Student Page 3.5.12B SERVING PORTION SLIPS.)
- Packing food containers with the Food Cards and Serving Portion Slips.
- Delivering the packaged food to the Supermarket Group.

The Supermarket Group

1	Manager
1–2	Shelf stockers
1	Check-out clerk
1	Bagger/messenger

Responsibilities include
- Making a food price list. (Before the round begins.)
- Sending the price list to the Newspaper Group. (Before the round begins.)
- Inventorying shelves.
- Placing orders for food with the Food Processor Group.
- Receiving food from the Food Processor Group.
- Pricing newly received foods.
- Stocking the shelves.
- Selling foods.
- Bagging foods.
- Banking the proceeds of sales.

The Consumer Group
2 Families of 2–3 people

Responsibilities include
- Determining serving portions for the food requirements of their family using the Activation, Regulation, and Fabrication (ARF) food group system. (Before the round begins.)
- Receiving cash from the Bank Group for their food budget.
- Planning meals using the published prices in the Newspaper's food ads.
- Making shopping lists and buying their foods at the Supermarket.
- Comparing the serving portions bought with the serving portions required for their meals.

- Determining the amount of leftover food.
- Recycling cans and cardboard containers to the Food Processor Group.

The Newspaper Group
1 Editor
3–4 Reporters

Responsibilities include
- Receiving a price list from the Supermarket Group. (Before the round begins.)
- Making up the ads. (Before the round begins.)
- Publishing a paper with food ads and stories of the previous round. (Optional)
- Reporting and writing up the events of the game for the next round of play.
- Delivering the newspaper to the Consumer Group.

The Bank Group
1 Manager
3–4 Bank clerks

Responsibilities include
- Paying the Consumers for work they have done.
- Receiving deposits from the Supermarket Group.
- Keeping track of money due to workers in each group. (See Student Page 3.5.11B INDIVIDUAL BANK ACCOUNT RECORDS.)
- Printing and minting money.

A game schedule for six teams (A, B, C, D, E, F) could look like this:

ROUND	GROUPS					
	Farm	Supermarket	Food Processor	Newspaper	Bank	Consumer
1	A	B	C	D	E	F
2	F	A	B	C	D	E
3	E	F	A	B	C	D
4	D	E	F	A	B	C
5	C	D	E	F	A	B
6	B	C	D	E	F	A

Adjustments can be made in the allotment of groups depending on the size of the class. For example, the Newspaper and Bank Groups can be run by the same team. If the class is very small, the newspaper can be produced by the Supermarket Group. Ads can be a simple reproduction of the price lists made by the Supermarket Group in the first round. The Bank can be placed with the Farm Group as the Farmers' Cooperative Banking Association.

STUDENT ROLES

Planner
Farmer
Food processor
Supermarket operator
Consumer
Newspaper person
Banker

MATERIALS

Student Page 3.5.9 SUPERMARKET GAME GROUPS

PRODUCT

Completed Student Pages

PROCEDURES

1. **Discuss how the Supermarket simulation will be organized with the students.**

   Include such things as
   - There will be 6 teams of 4–5 students.
   - There will be 6 groups: the Farm, Food Processor, Bank, Newspaper, Supermarket, and Consumer Groups.
   - The game will be played for 6 rounds so that every team works at the jobs in each group.

2. **Discuss the jobs and responsibilities of each group. Have the students list jobs and responsibilities for each group on Student Page 3.5.9 SUPERMARKET GAME GROUPS.**

   - Farm Group
     1 Manager
     2–3 Independent farmers
     1 Quality control expert

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- Food Processor Group
  1 Manager
  2–3 Packers
  1 Quality control expert

- Supermarket Group
  1 Manager
  1–2 Shelf stockers
  1 Check-out clerk
  1 Bagger/messenger

- Consumer Group
  2 Families of 2–3 people

- Newspaper Group
  1 Editor
  3–4 Reporters

- Banker Group
  1 Manager
  3–4 Bank clerks

3. **Have the students carry out Activities 3.10.10 SUPERMARKET PLANNING, 3.10.11 SUPERMARKET CONSTRUCTION, 3.5.10 PRICING FOODS, 3.5.11 NEWSPAPER ADS AND BANKING, 3.5.12 FARMERS AND PROCESSORS, 3.5.1 FOOD SELECTION, and 3.5.13 SUPERMARKET GAME.**

EXTENSION

Have the students
- Make posters of the jobs and responsibilities of each group to hang in the assigned group area during the Supermarket Game.

3.5.10 PRICING FOODS

OBJECTIVES

The students
- Recycle clean, empty food containers for their supermarket simulation.
- Use newspaper food ads and observations from neighborhood food stores to determine the average price for foods they plan to have in their supermarket.
- Price the foods in their collection for the supermarket simulation.

BACKGROUND

This activity is part of the operational side of the supermarket sequence and is done concurrently with Activities 3.10.10 SUPERMARKET PLANNING, 3.10.11 SUPERMARKET CONSTRUCTION, 3.5.9 SUPERMARKET GAME PREPARATION, 3.5.11 NEWSPAPER ADS AND BANKING, and 3.5.12 FARMERS AND PROCESSORS.

In this activity the class makes a list of the foods they want to have available in their supermarket. They collect or make the food containers that will be used in it. They determine the average prices that are being asked for such food items by visiting their own food stores or reading local newspaper ads and set a price for items that will be sold.

The idea of an average price may require the introduction of a new mathematical idea. If the concept of averaging has not been or will not be introduced during the current school year, the most common price of the food or a guessed price that seems to be about in the middle of the price range can be used. Calculators can be used to find the average prices.

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STUDENT ROLES

Recycler
Store owner
Store manager
Store clerk

MATERIALS

chart paper
markers
clean, empty food cans, boxes, jars, and other containers with labels
clean meat trays
materials to construct other food containers as needed
newspaper food ads
Student Pages 3.5.10A PRICING FOODS
3.5.10B SALE PRICES

PRODUCTS

Food prices for the supermarket
Completed Student Pages

PROCEDURES

1. **Have the class make a list of the foods they plan to have available in their Supermarket.**

2. **Have the students bring in clean, empty food containers with labels on them. Use Student Page 3.5.10 PRICING FOODS to keep a record of the containers collected and needed.**

   Have the students
   - List foods by categories or sections found in supermarkets, for example, canned goods, dairy products, frozen foods, breads, meats, etc., using a separate page for each category.
   - Check off the containers as they are collected.
   - Keep track of the foods that come in containers that are to be included in the Class Supermarket but are not yet in their container collection.
   - Make boxes, other containers, and labels for missing items.

- List foods such as certain meats and fresh fruits and vegetables that don't normally come in containers.
- Collect clean paper or plastic grocery bags.

3. **Have teams choose food categories to research. Have them find the prices of these items at stores and in newspaper food advertisements. Have them use Student Page 3.5.10 PRICING FOODS to record their findings.**

   Ask such questions as these:
   - Are foods always the same price in different stores? Why might this be so?
     ✔ Usually the prices will vary. Work to ideas such as there are different grades of the same kinds of foods, some stores have items on sale while others don't, and there are different kinds of stores. Convenience stores usually charge more than supermarkets.

   - Did anyone find different prices on exactly the same item in different stores? Why might this be so?
     ✔ Again, get at the ideas that some small convenience stores charge more because they have more personalized service, some items may be on sale, or some items may be reaching an expiration date beyond which they cannot be sold.

   - Do stores have all their items on sale?
     ✔ Work toward the observation that only a few items are usually on sale. This can be seen in newspaper ads.

   - Why do stores have sales?
     ✔ Several ideas can be brought out here such as the need to get rid of high inventory, to encourage people to shop at that store, to boost lagging sales, to promote new items, and to compete with other brands of food.

   - What are the disadvantages of sales for the stores.
     ✔ Work to the idea that they usually make less money on the sale items. However, customers usually buy other items that are not on sale at the same time.

4. **Have each team find the average price or the most common price of each food on their category lists.**

5. **Have the students discuss pricing the foods on their category lists.**

   Have the students
   - Report their team's suggested prices and pricing methods.
   - Make a base price list for all foods using the average prices on each team's Student Page 3.5.10A PRICING FOODS.
   - Agree on a common method for repricing foods for each round.
     ✔ For example, there can only be 10 items on sale and only 5 price increases. All other items remain at the base price.

6. **Have each team decide on their price list changes for the round in which they will be the Supermarket Group and give it to the team that will be the Newspaper Group for that same round. Have them use Student Page 3.5.10B SALE PRICES.**

EXTENSION

- Invite a supermarket manager to talk about pricing in the store and career opportunities.

3.5.11 NEWSPAPER ADS AND BANKING

OBJECTIVES

The students
- Produce newspaper advertisement sheets.
- Manufacture money.
- Make sale signs.
- Cash checks.
- Collect supermarket deposits and pay workers.

BACKGROUND

This activity develops the functions of the Newspaper and Banking Groups in the supermarket simulation prior to and during the game.

Before the game, each team prepares a newspaper advertisement sheet to be used in the round when they are the Newspaper Group. They use the prices and specials of the team that will operate the supermarket during that round. See Activity 3.5.10 PRICING FOODS.

Sale signs for the store are also made by each team for the round when they become the Newspaper Group. This may be done before or during the early part of each round in the simulation.

Any waiting time during the simulation can be used by the Newspaper Group to interview other groups and produce a newspaper or video report of life and work in the Supermarket Game.

Before the game begins, some teams or all the students can be involved in making the money to be used in the simulation. This is an opportunity to introduce plaster-of-paris casting to make game coins. Real coins or play coins with raised numbers can be pressed into modeling clay to make a cast. This clay cast can then be filled with plaster of paris. Game coins should be about 4–5 mm thick to keep them from breaking. Raised numbers can be made with heavy trails of quick-drying glue. Linoleum block printing or other techniques can be used to make bills. Cardboard coins and paper bills will work equally well. Checks can be made in similar way to bills.

The Bankers give money to the Consumers for their food budget. This amount is recorded on the Bank Ledger. The Bankers receive all

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money taken in by the Supermarket as a deposit and record the amount. Bankers also keep records of all team earnings which are withdrawn by the team when they become Consumers. If there are several families in the Consumer Group, divide the team's assets according to the number of members in each family.

At the start of round one, the Bankers credit all teams with equal starting assets for example $100.00. The amount should be sufficient to cover the food budgets for the Consumer Group. See Activity 3.5.1 FOOD SELECTION. Other options are to allow the Consumer Group to take out a loan from the Bank that must be repaid at the end of the last round or to run negative balances. See Figure 3.5.11 Sample Bank Ledger Pages.

At the end of each round, the money deposited by the Supermarket Group is divided by the Bankers between the groups on the ledger as follows:

- Give 2/10 to the Farm Group.
- Give 3/10 to the Food Processor Group.
- Give 3/10 to the Supermarket Group.
- Give 1/10 to the Newspaper Group.
- Give 1/10 to the Bank Group.

See Figure 3.5.11 Sample Bank Ledger Pages.

If the students have difficulty with the fractions, have the Consumer Group withdraw a fixed amount such as $10.00 for each family member. Using this system, for each $10.00 that is deposited in the Bank by the Supermarket Group, the Farm Group receives $2.00 on the ledger; the Food Processor Group receives $3.00; the Supermarket Group, $3.00; the Bank Group, $1.00; and the Newspaper Group, $1.00. See Figure 3.5.11 Sample Bank Ledger Pages for an example.

The Bankers will record deposits from the Supermarket. Credits can be given at the beginning or end of each round.

STUDENT ROLES

Ad writer
Newspaper reporter
Minter
Banker

MATERIALS

paper
cardboard
markers
scissors
copying machine access (optional)
modeling clay (optional)
plaster of paris (optional)
small bottle lids (optional)
thick, quick-setting glue (optional)
linoleum (optional)
linoleum cutters (optional)
printing ink (optional)
ink brayer (optional)
video equipment (optional)
Student Page 3.5.11 BANK LEDGER
Completed Student Pages 3.5.10 PRICING FOODS

PRODUCTS

Money for the game
Newspaper food advertisement sheets
Sale signs
Completed Student Pages

PROCEDURES

1. **Before the game begins have the students decide how the Newspaper Group will make food advertisement sheets.**

   Help them consider questions such as
   - How many sheets for the Consumer Group?
   - How to copy multiple sheets for the Consumer and other groups.
   - Should the ads be hand-drawn?
   - Should the ads be a collection of pictures from newspapers or magazines?
   - Should the ads be a list of specials only?
   - Should the ads include the entire base price list from 3.5.10 PRICING FOODS?

- Should the advertisement sheets also include news items?

2. **Before the game begins, have each team make an advertisement sheet for the team that will run the Supermarket for the round when they become the Newspaper Group. See Activity 3.5.10 PRICING FOODS.**

   Have each team
   - Collect the list of specials from the Supermarket Group.
   - Make a proof.
   - Submit the proof to the Supermarket Group for any needed corrections.
   - Make any necessary corrections and a final copy.
   - Store the copy for the game.

3. **Before the game begins, have the students discuss the money system to be used. This should include common coins and bills up to $50 denominations. The total amount in circulation should be $500–$2,000, depending on the system and number of students.**

   Have the class decide
   - The number of each type of coin to be minted.
   - The size and shape of each type of coin.
   - The materials to be used for the coins.
   - The figure to be stamped on each side of the coins.
   - The number of each type of bill to be printed.
   - The size and shape of bills.
   - The figures to be put on each side of the bills.
   - The size and shape of checks.
   - The printing to go on each check.

4. **Introduce the class to any special techniques for making the money and have them manufacture it.**

5. **Before the game begins, discuss how money will be distributed to the groups.**

   Give the class the following information and ask such questions as these:

   - Of the sale price of food 2/10 or 1/5 ($2 out of $10) goes to pay the farmers. What do you think the farmers do with this money?
     ✔ Get at the ideas of buying seeds, fertilizer, equipment; paying taxes; and paying for personal living expenses.

   - Of the sale price of food 3/10 ($3 out of $10) goes to the food processors after the processors pay the farmers. What do you think the food processors do with this money?
     ✔ Get at the ideas of buying equipment, paying workers, renting buildings, transporting products, paying taxes, and paying personal living expenses.

   - Supermarket operators charging average prices for food, make about 3/10 of the sales price ($3 out of $10) after they pay the food processors and advertisers. What do you think the supermarket operators do with this money?
     ✔ Get at the idea of paying employees, rent, utilities, advertisements, taxes, and personal expenses.

   - About 1/10 ($1 out of $10) goes for advertising and other services. What do you think advertisers do with this money?
     ✔ Get at the idea of paying workers, buying equipment, paying rent, buying supplies such as paper, and paying property taxes.

   - In the whole system 1/10 ($1 out of $10) goes to the banking system. What do you think bankers do with this money?
     ✔ Get at the ideas of paying workers, buying equipment, paying taxes and interest to depositors.

6. **At the beginning of each round of the game have the Newspaper Group make the sale signs for the Supermarket's specials while the new Supermarket Group is setting up for the new round.**

7. **At the beginning of each round have the Bank Group provide money to the Consumer Group according to the amount budgeted for each family member.**

   - The Consumer Group withdraws money from the bank by check.
   - The Bankers record the amount withdrawn on Student Page 3.5.11 BANK LEDGER.

8. **During the game, the Bankers receive the Supermarket's deposit of receipts and pay the workers in each group by crediting the team accounts. Records are kept on Student Page 3.5.11 BANK LEDGER.**

9. **(Optional) The Newspaper Group can interview the other groups and produce a newspaper or video account of the supermarket simulation. Bankers can volunteer to help other short-handed groups if they have extra time during a round.**

EXTENSION

- Have the class make a video documentary of the entire supermarket simulation.

ILLUSTRATIONS

Round: 1

BANK DISTRIBUTION OF SUPERMARKET RECEIPTS OF $100

	CREDIT	DEBIT	BALANCE
Team A			100.00
Group: Farm	20.00		120.00
Team B			100.00
Group: Food Processor	30.00		130.00
Team C			100.00
Group: Newspaper	10.00		110.00
Team D			100.00
Group: Bank	10.00		110.00
Team E			100.00
Group: Supermarket	30.00		130.00
Team F			100.00
Group: Consumer		100.00	00

Team F
as
Consumer
expends
$100

Round: 2

BANK DISTRIBUTION OF SUPERMARKET RECEIPTS OF $80

	CREDIT	DEBIT	BALANCE
Team A			120.00
Group: Farm	24.00		144.00
Team B			130.00
Group: Food Processor	8.00		138.00
Team C			110.00
Group: Newspaper	8.00		118.00
Team D			110.00
Group: Bank	24.00		134.00
Team E			130.00
Group: Supermarket		80.00	50.00
Team F			.00
Group: Consumer	16.00		16.00

Team
as
Consumer
expends
$80

Round: 3

BANK DISTRIBUTION OF SUPERMARKET RECEIPTS OF $90

	CREDIT	DEBIT	BALANCE
Team A			144.00
Group: Farm	9.00		153.00
Team B			138.00
Group: Food Processor	9.00		147.00
Team C			118.00
Group: Newspaper	27.00		145.00
Team D			134.00
Group: Bank		90.00	44.00
Team E			50.00
Group: Supermarket	18.00		68.00
Team F			16.00
Group: Consumer	27.00		43.00

Team D
as
Consumer
expends
$90

Round: 4

BANK DISTRIBUTION OF SUPERMARKET RECEIPTS OF $70

	CREDIT	DEBIT	BALANCE
Team A			153.00
Group: Farm	7.00		160.00
Team B			147.00
Group: Food Processor	21.00		168.00
Team C			145.00
Group: Newspaper		70.00	75.00
Team D			44.00
Group: Bank	14.00		58.00
Team E			68.00
Group: Supermarket	21.00		89.00
Team F			43.00
Group: Consumer	7.00		50.00

Team C
as
Consumer
expends
$70

Round: 5

BANK DISTRIBUTION OF SUPERMARKET RECEIPTS OF $90

	CREDIT	DEBIT	BALANCE
Team A			160.00
Group: Farm	27.00		187.00
Team B			168.00
Group: Food Processor		90.00	78.00
Team C			75.00
Group: Newspaper	18.00		93.00
Team D			58.00
Group: Bank	27.00		85.00
Team E			89.00
Group: Supermarket	9.00		98.00
Team F			50.00
Group: Consumer	9.00		59.00

Team B
as
Consumer
expends
$90

Round: 6

BANK DISTRIBUTION OF SUPERMARKET RECEIPTS OF $100

	CREDIT	DEBIT	BALANCE
Team A			187.00
Group: Farm		100.00	87.00
Team B			78.00
Group: Food Processor	20.00		98.00
Team C			93.00
Group: Newspaper	30.00		123.00
Team D			85.00
Group: Bank	10.00		95.00
Team E			98.00
Group: Supermarket	10.00		108.00
Team F			59.00
Group: Consumer	30.00		89.00

Team A
as
Consumer
expends
$100

Figure 3.5.11 Sample Bank Ledger Pages

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3.5.12 FARMERS AND PROCESSORS

OBJECTIVES

The students
- Discuss the roles of farmers and food processors.
- Make and process foods for their supermarket.

BACKGROUND

This activity develops the functions of the Farm Group and the Food Processor Group in the Supermarket Simulation. It is used prior to and during the game.

The Farm Group makes Food Cards for each of the raw foods that it produces. This includes fruits, vegetables, meats, dairy products, etc. The foods are represented by logos. Part of working on the farm consists of drawing these on the Food Cards when orders are received from the Food Processor Group.

Many containers will have a single main food. For example a can of tomatoes has mainly tomatoes. A turkey pot pie, on the other hand, has a combination of ingredients. A single card with a logo representing this combination of ingredients is made to indicate that the farmers have produced the turkey, potatoes, peas, etc., in the pie.

The Food Processor Group receives orders from the Supermarket Group and places orders for food with the Farm Group. The Food Processing Group cuts out the Serving Portion Slips that are inserted with the Food Cards into containers. There should be one Serving Portion Slip for each serving in the container. Serving sizes are given on most containers. Information on serving sizes is found in Activity 3.5.1 FOOD SELECTION. The Food Processors also make additional containers and labels if needed to fill the Supermarket's orders. They deliver the packaged food to the Supermarket.

To ensure that all groups are fully employed, the last order to the Food Processors for recycled containers is left for the next team to send. Similarly the last order for produce is left for the next team of Farmers to fill.

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STUDENT ROLES

Artist
Farmer
Food processor

MATERIALS

markers or crayons
scissors
Student Pages 3.5.12A FOOD CARDS
3.5.12B SERVING PORTION SLIPS

PRODUCTS

Completed Student Pages

PROCEDURES

1. **Before the game begins, discuss the responsibilities of the Farmers with the class.**

   Help the students include
   - Receiving orders from the Food Processors.
   - Producing the foods needed to fill the orders.
   - Delivering the food to the Food Processors.

2. **Before the simulation starts, discuss with the students the responsibilities of the Food Processors.**

   Help them include
   - Receiving recycled containers from the Consumers.
   - Ordering foods (Food Cards and Serving Portion Slips) from the Farmers based on the number of recycled containers.
   - Receiving produce and animal products from the Farmers.
   - Packing containers with Food Cards and Serving Portion Slips.
   - Receiving orders for food from the Supermarket.

- Delivering the orders to the Supermarket.

3. **Discuss the use of the Food Cards and Serving Portion Slips with the class.**

   Describe their functions to the students.
   - Food Cards and Serving Portion Slips go into every container (can, box, meat tray, etc.) and display of fresh vegetables and fruits.

   - One Food Card for the main ingredient other than water goes into each container.
     ✔ A box of wheat cereal would have a wheat Food Card.

   - One Food Card for combination foods such as pizza or chicken pot pie goes into each appropriate container.

   - One Serving Portion Slip for each serving goes into the container.
     ✔ A 16-oz can of tomatoes contains four 4 oz servings. It would have 4 Serving Portion Slips.

4. **Have the students invent logos for the principal raw foods and for the combination foods that they plan to have available in their supermarket. (See lists made in Activity 3.5.10 PRICING FOODS.)**

   Have them
   - List the principal foods in the containers.

   - Invent logos for the listed foods.

   - Decide which logos to use.

5. **Have the class make Food Cards and Serving Portion Slips to fill most of the containers before starting the game. Use Student Page 3.5.12A FOOD CARDS and Student Page 3.5.12B SERVING PORTION SLIPS.**

6. **Have the students pack the containers to be used in the Supermarket with Food Cards and Serving Portion Slips. Have the quality control expert check the packing.**

7. **During the game the Farmers make additional Food Cards and Serving Portion Slips to fill orders from the Food Processors. One group member should serve as farm manager and another as the quality control expert.**

8. **During the game the Food Processors send out orders to the Farmers as the recycled containers are received from the Consumers. They pack containers as produce (Food Cards and Serving Portion Slips) is received from farmers. One group member should serve as the food processing plant manager and another as quality control expert. A third student can be responsible for shipping the packaged foods to the Supermarket.**

3.5.13 SUPERMARKET GAME

OBJECTIVES

The students
- Play the supermarket simulation game.
- Relate the simulation to the "real life" components of complex supermarket food systems.

BACKGROUND

This activity concludes the supermarket sequence in the playing of the Supermarket Game. It should be preceded by Activities 3.5.9 SUPERMARKET PREPARATION, 3.10.10 SUPERMARKET PLANNING, 3.10.11 SUPERMARKET CONSTRUCTION, 3.5.10 PRICING FOODS, 3.5.11 NEWSPAPER ADS AND BANKING, 3.5.12 FARMERS AND PROCESSORS, and 3.5.1 FOOD SELECTION.

To play the game, the class is divided into teams to carry out the job responsibilities of the game's Farm, Food Processor, Supermarket, Newspaper, Bank, and Consumer Groups. The game is normally played for six rounds so that each student has the opportunity to carry out one or more jobs of all six groups. See Activity 3.5.9 SUPERMARKET GAME PREPARATION for further information.

Some preparation work should be left to do at the beginning of the game. The Farm Group should have some foods to draw (Activity 3.5.12). The Food Processor Group should have some containers to fill (Activity 3.5.12). The Supermarket Group should have some shelves to stock. The Bank Group should have some bookkeeping to do (Activity 3.5.11). Some work should also be left unfinished at the end of each round.

Round 1 and its discussion are designed to get the simulation functioning smoothly. All the components of the game are tested and the students get a sense of what they are to do when they take on responsibilities of other groups in the following rounds.

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STUDENT ROLES

Farmer
Food processor
Supermarket operator
Consumer
Newspaper person
Banker

MATERIALS

supermarket
other game equipment as designed and built by the students
Connections Book
Student Page 3.5.13 SUPERMARKET GAME SUMMARY

PRODUCTS

Operating supermarket
Completed Student Pages

PROCEDURES

1. **Have the students play Round 1. After the round, have them discuss what happened.**

   Ask such questions as these:
   - What did your group do?
   - Were there any problems?
   - What can we do to make the next round go more smoothly?

2. **Have the teams play the remaining rounds with discussion as needed.**

3. **After the simulation has been completed, summarize the game with the class. Have the students record their ideas in the Connections Book.**

   Ask such questions as these:
   - How were the things that the Farm Group did in the game similar to what real farmers do? How were they different?

- How were the things that the Food Processor Group did in the game similar to what real food processors do? How were they different?
- How were the things that the Supermarket Group did in the game similar to what happens in a real supermarket? How were they different?
- How were the things that the Consumer Group did in the game similar to what real consumers do? How were they different?
- How were the things that the Newspaper Group did in the game similar to what real newspaper people do? How were they different?
- How were the things that the Bank Group did in the game similar to what real bankers do? How were they different?

EXTENSIONS

Have the students

- Make a diagram showing the movement of food, containers, and money between all groups.
- Make a diagram showing how the jobs and groups in the game are related.

DASH

FOOD SELECTION
SP 3.5.1A
Page 1

Name: ____________________

Date: ____________________

FOOD	SERVING SIZE	ARF GROUP
APPLE	one	
BABY FOOD	1 jar	
BABY FORMULA	8 oz.	
BACON	2 slices	
BANANA	one	
BEANS, CANNED WITH PORK	1 cup	
BEANS, GREEN	1/2 cup	
GROUND BEEF OR STEAK	3 oz.	
BEEF STEW, CANNED	1 cup	
BOLOGNA OR OTHER LUNCH MEAT	1 (1 oz.) slice	
BREAD	1 slice	
BROCCOLI	1/2 cup	
BUTTER	1 tablespoon	
CABBAGE	1/2 cup	
CARROTS	1/2 cup	

DASH

FOOD SELECTION
SP 3.5.1A
Page 2

Name: ______________________

Date: ______________________

FOOD	SERVING SIZE	ARF GROUP
CATSUP	1 tablespoon	
CAULIFLOWER	1/2 cup	
CELERY	1 stalk	
CEREAL	1 cup	
CHEESE	1 (1 oz.) slice	
CHICKEN	2 pieces	
CHILI WITH BEANS, CANNED	1 cup	
EGG	one	
FISH	3 oz.	
FRUIT JUICE	1 cup	
GELATIN	1/2 cup	
GRAPES	10 large	
HAM	3 oz.	
HOT DOG	one	
ICE CREAM	1/2 cup	

DASH

FOOD SELECTION
SP 3.5.1A
Page 3

Name: ____________________

Date: ____________________

FOOD	SERVING SIZE	ARF GROUP
JELLY	1 tablespoon	
LETTUCE	1/2 cup	
MACARONI AND CHEESE	1 cup	
MARGARINE	1 tablespoon	
MILK	1 cup	
NOODLES	1 cup	
ORANGE	one	
PEACHES, CANNED	1/2 cup	
PEANUT BUTTER	2 tablespoons	
PEARS, CANNED	1/2 cup	
PEAS	1/2 cup	
PORK	3 oz.	
POTATO	1 large	
RAISINS	1-1/2 oz.	
RICE	1/2 cup	

DASH

FOOD SELECTION
SP 3.5.1A
Page 4

Name: ____________________

Date: ____________________

FOOD	SERVING SIZE	ARF GROUP
SALAD DRESSING	1 tablespoon	
SAUSAGE	3 links	
SHRIMP	5 pieces	
SPAGHETTI AND MEAT SAUCE, CANNED	1 cup	
SPINACH	1/2 cup	
SQUASH	1/2 cup	
SUGAR	1 tablespoon	
TOMATO	one	
TUNA, CANNED	1/2 cup	
YAM	1 small	

DASH

FOOD SERVINGS
SP 3.5.1B Page 1

Name: ______________________

Date: ______________________

How many people in your family?

ARF GROUP	BREAKFAST SERVINGS	LUNCH SERVINGS	DINNER SERVINGS	TOTAL NUMBER OF SERVINGS FOR ONE PERSON	TOTAL NUMBER OF SERVINGS FOR THE FAMILY
Activation				4	
Regulation				4	
Fabrication				4-6	

BREAKFAST MENU

FOOD	NUMBER OF SERVINGS NEEDED

DASH

FOOD SERVINGS
SP 3.5.1B Page 2

Name: ____________________

Date: ____________________

LUNCH MENU	
FOOD	NUMBER OF SERVINGS NEEDED

DINNER MENU	
FOOD	NUMBER OF SERVINGS NEEDED

DASH

SHOPPING LIST
SP 3.5.1C

Name: ______________________

Date: ______________________

FOOD	ARF GROUP	Breakfast, Lunch, or Dinner	Number of Servings	Number of Containers	Cost of Each Container	Total Cost
FOOD BUDGET $				TOTAL COST OF SHOPPING LIST		

DASH

LEFTOVERS
SP 3.5.1D

Name: ______________________

Date: ______________________

FOOD	SERVINGS BOUGHT	SERVINGS NEEDED	SERVINGS LEFT OVER

DASH

GARDEN FOOD PLANTS
SP 3.5.2

Name: ______________________

Date: ______________________

PLANT	GROWING CHARACTERISTICS AND NEEDS	FOOD GROUP

DASH

CLASS FEAST PLAN
SP 3.5.3

Name: ____________________

Date: ____________________

Planning assignment:

Planning team:

PLANNING IDEAS	REVISED PLAN

SP 3.5.4

DASH

CLASS FEAST
RECIPE
SP 3.5.4

Name: ____________________

Date: ____________________

GENERAL DIRECTIONS:

TEMPERATURE: __________

ORIGINAL TIME: __________

NEW TIME: __________

NUMBER OF SERVINGS IN ORIGINAL RECIPE: __________

NUMBER OF SERVINGS NEEDED: __________

INGREDIENT	ORIGINAL AMOUNT	NEW AMOUNT

DASH

CLASS FEAST SUMMARY
SP 3.5.5

Name: ____________________

Date: ____________________

GROUP PROJECT:

GROUP MEMBERS:

What went well?

What might we do differently next time?

What did we learn?

DRYING FOODS
SP 3.5.6

Name: ____________________

Date: ____________________

Describe or draw and label your process for drying seeds.
TYPE OF SEED: ____________________

Describe or draw and label your process for drying fruits or vegetables.
TYPE OF FOOD: ____________________

DASH

PICKLING FOODS
SP 3.5.7

Name: ____________________

Date: ____________________

FOOD TO BE PICKLED:

PICKLING GROUP:

PICKLING RECIPE

DESCRIBE HOW YOU PICKLED YOUR FOOD:

DESCRIBE HOW YOUR PICKLED FOOD TASTED

BEFORE PICKLING	RIGHT AFTER PICKLING	ONE WEEK LATER	END OF YEAR

DASH

PRESERVING AND ROTTING: PREDICTIONS AND PLANNING
SP 3.5.8A

Name: ______________________

Date: ______________________

What are your hypotheses about the preserving and rotting of seeds and foods?

Draw and label or describe your plan for the experiment.

DASH

PRESERVING AND ROTTING: OBSERVATIONS SP 3.5.8B

Name: ______________________

Date: ______________________

TEAM:

FOOD OR SEED:

METHOD OF PRESERVATION:

DATE	OBSERVATIONS	
	EXPERIMENTAL SAMPLE	CONTROL SAMPLE

CONCLUSIONS:

What did you learn from doing this experiment?

DASH

SUPERMARKET GAME GROUPS
SP 3.5.9

Name: ____________________

Date: ____________________

List the responsibilities for each group.

Farm Group	Food Processor Group
Supermarket Group	Consumer Group
Newspaper Group	Bank Group

SP 3.5.10A

DASH

PRICING FOODS
SP 3.5.10A

Name: ____________________

Date: ____________________

FOOD CATEGORY:

FOOD	NUMBER OF CONTAINERS NEEDED	CONTAINER SIZE	PRICE 1	PRICE 2	PRICE 3	AVERAGE PRICE

SP 3.5.10B

DASH

SALE PRICES
SP 3.5.10B

Name: ____________________

Date: ____________________

ROUND:

TEAM MEMBERS:

SALE PRICES FOR NEWSPAPER ADS

FOOD ITEM	QUANTITY OR CONTAINER SIZE	SALE PRICE

DASH

BANK LEDGER
SP 3.5.11

Name: ____________________

Date: ____________________

Round:			
BANK DISTRIBUTION OF SUPERMARKET RECEIPTS OF ________			
	CREDIT	DEBIT	BALANCE
Team A			
Group:			
Team B			
Group:			
Team C			
Group:			
Team D			
Group:			
Team E			
Group:			
Team F			
Group:			

DASH

SERVING PORTION SLIPS
SP 3.5.12B

Name: ____________________

Date: ____________________

1 SERVING	1 SERVING	1 SERVING	1 SERVING	1 SERVING	1 SERVING	1 SERVING
1 SERVING	1 SERVING	1 SERVING	1 SERVING	1 SERVING	1 SERVING	1 SERVING
1 SERVING	1 SERVING	1 SERVING	1 SERVING	1 SERVING	1 SERVING	1 SERVING
1 SERVING	1 SERVING	1 SERVING	1 SERVING	1 SERVING	1 SERVING	1 SERVING

SUPERMARKET GAME SUMMARY SP 3.5.13

Name: ____________________

Date: ____________________

Describe the thing you enjoyed most about the game.

Describe the most difficult thing for you to do in the game.

DASH

GRADE THREE
CLUSTER 6

HEALTH AND SAFETY

3.6.1 Growth Chart
3.6.2 Tooth Chart
3.6.3 Breathing Air
3.6.4 Anatomy of Breathing
3.6.5 Lung Model
3.6.6 Lungs and Smoking
3.6.7 Breathing and Pulse Rates
3.6.8 Heart, Veins, and Arteries
3.6.9 Heart, Lungs, and Exercise
3.6.10 Disease Transmission
3.6.11 Trash and Sanitation
3.6.12 Helpful Drugs
3.6.13 Proper Drug Use

3.6.1 GROWTH CHART

OBJECTIVES

The students
- Measure their height and weight.
- Determine the area covered by their hands and feet.
- Compare their third grade measurements with their earlier grade measurements.
- Predict what their next measurements will be.
- Graph their growth from kindergarten.

BACKGROUND

This is a continuation of a project begun in grade K that will continue through grade 6. The students measure their height and weight. They determine the area of their hands and feet using grid paper. These measurements are compared with previous years' measurements to give the students a sense of their own growth and the variability of growth in people.

Student Page 3.6.1A is the same as the student page used in grades K-2. It is simply for data collection. In third grade the students begin to calculate and graph their changes in growth. Have them use the information collected in previous years to complete Student Page 3.6.1C CHANGES IN GROWTH.

Have the students keep their fingers together on the hand that they trace. By putting their arm at a right angle to their hand, they will be able to trace around the bottom of their palm. If the grid paper is too small to fit the students' hands or feet, have them invent a way to make a larger grid area using a second student page.

Third grade students are usually able to find the area of their hands and feet. One technique is to have the students number the squares as they count them. Have them include squares that are over one-half covered. They should not count squares that are covered less than one-half. Have the students determine their hand and foot area from previous years if they have kept those outlines.

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To graph the range of class data use large-size grid paper. Label the axes. Be sure to label and include the highest and lowest data points. Have the students mark their own data point. Draw a box around all the data points. See Figure 3.6.1 Sample Height Graphs.

STUDENT ROLES

Mathematician
Physician

MATERIALS

centimeter or quarter-inch graph paper for individual graphs
large grid paper for class graphs
scales
meter stick or tape
Student Pages 3.6.1A GROWTH CHART
3.6.1B HAND AND FOOT CHART
3.6.1C CHANGES IN GROWTH

PRODUCTS

Graphs showing personal and class growth
Completed Student Pages

PROCEDURES

1. **Have the students work in pairs to measure their height and weight and determine the area of their hands and feet.**

   Have them record
   - Height in centimeters and inches.
   - Weight in kilograms and pounds.
   - Foot and hand area in number of square centimeters.

2. **Have the students compare their latest measurements with those taken in previous grades using Student Pages 3.6.1C CHANGES IN GROWTH.**

   Have them compute
   - Changes in height in centimeters.
   - Changes in weight in kilograms.

- Changes in hand and foot area in square centimeters.

3. **Have the students make graphs showing their own growth since kindergarten and the range of the class data. See Figure 3.6.1 Sample Height Graphs.**

Have them graph
- Their own growth in height, weight, and hand and foot area year by year since kindergarten using the measurements taken at the beginning of each year.

- Their growth change in height, weight, and hand and foot area year by year since kindergarten using the measurements taken at the beginning of each year.

- The range of class data for height, weight, and hand and foot area year by year since kindergarten using the measurements taken at the beginning of each year.

- The range of class data for changes in height, weight, and hand and foot area year by year since kindergarten using the measurements taken at the beginning of each year.

4. **Discuss how the students are growing.**

Ask such questions as these:
- Are there any examples of decreases in height or weight?
  ✔ There may be decreases in weight.

- Has everyone grown the same amount as everyone else? Why might this be so?
  ✔ Get at the idea that we are all different in the way we grow.

- Which of the measurements show the greatest overall increase?

- What do you think your measurements will be the next time we take them?

- Did you grow the same amount each year?
  ✔ The amount of change in different dimensions will be different each year and will eventually be zero.

EXTENSIONS

- Have the students compare their growth between kindergarten and the first and second grades with their growth between grade two and grade three.
- Have the students make individual graphs showing their personal growth from kindergarten through grade three for each of their four measurements.

ILLUSTRATIONS

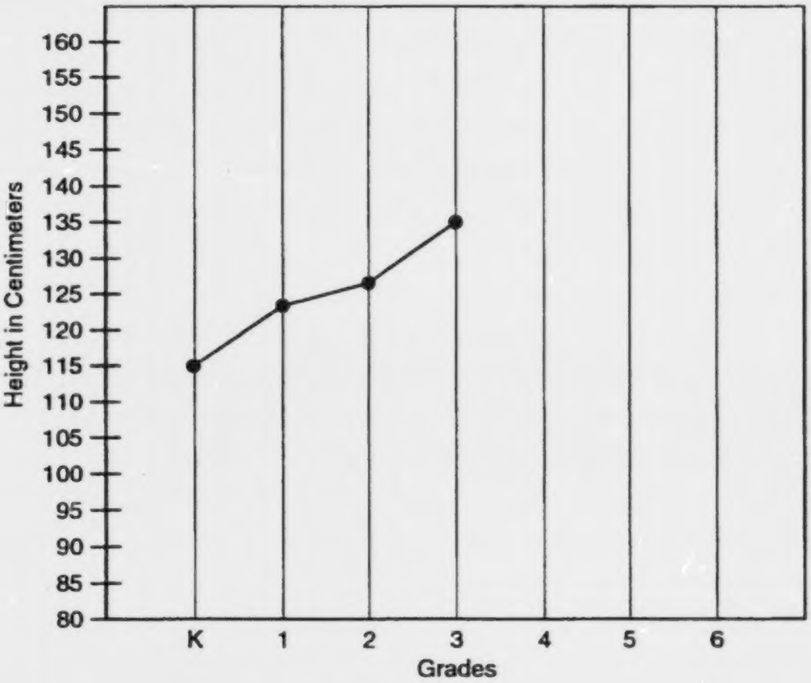

Figure 3.6.1 Sample Height Graphs

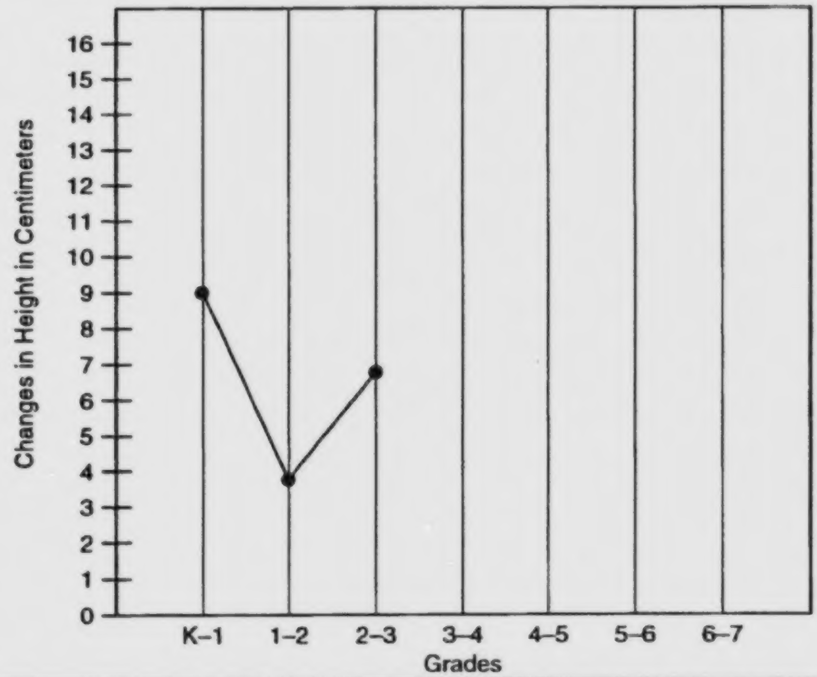

Figure 3.6.1 Sample Height Graphs

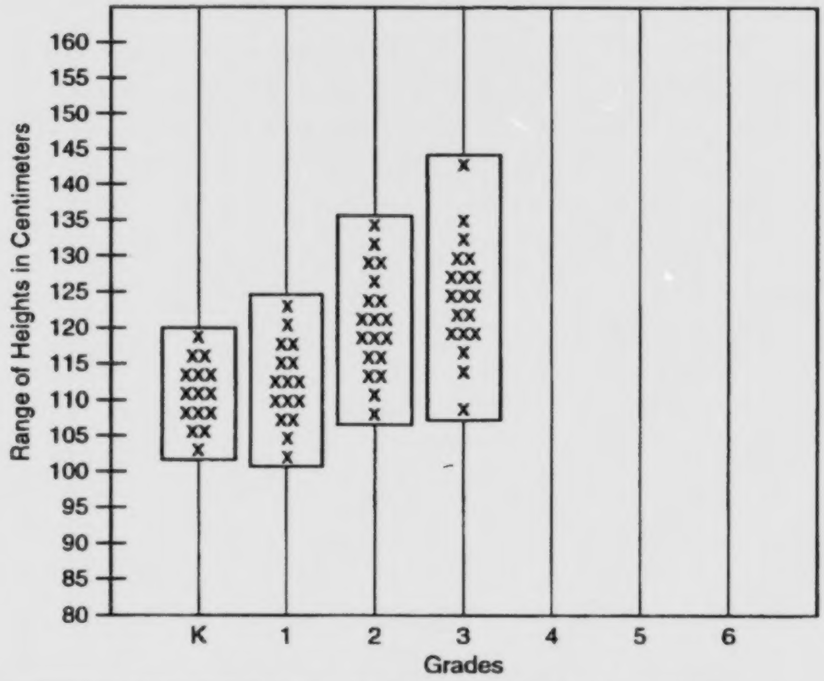

Figure 3.6.1 Sample Height Graphs

412

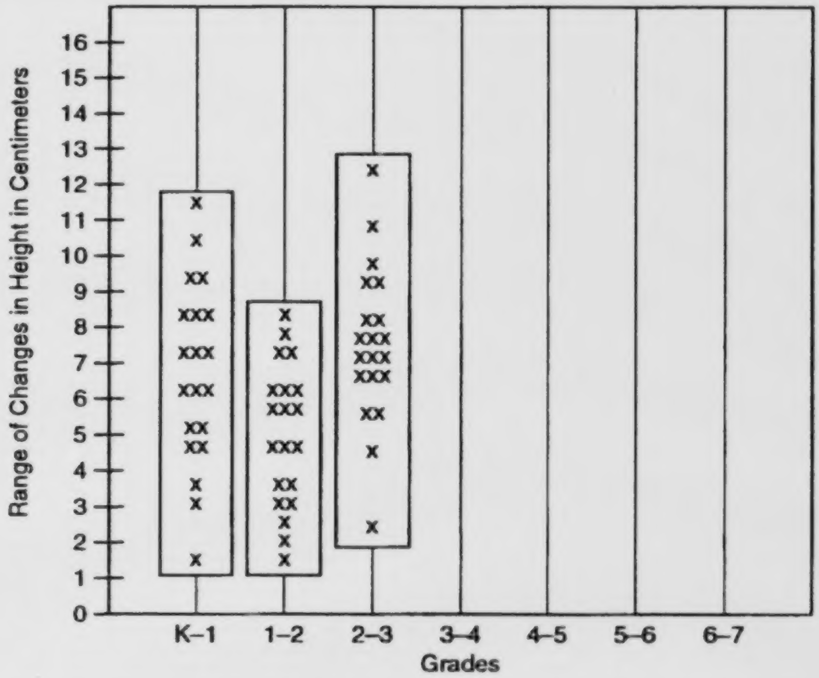

Figure 3.6.1 Sample Height Graphs

3.6.2 TOOTH CHART

OBJECTIVES

The students
- Continue keeping records of their number of teeth.
- Continue keeping records of their number of cavities.
- Continue keeping records of their number of missing teeth.
- Graph their personal and class tooth information.

BACKGROUND

This activity continues a K–6 record-keeping project that provides an ongoing log of tooth loss, new teeth, and the appearance of cavities and fillings. This is a parallel activity to Activity 3.6.1 GROWTH CHART. By keeping long-term records, the students develop a sense of natural biological growth and change.

STUDENT ROLES

Dentist
Dental hygienist

MATERIALS

centimeter or quarter-inch graph paper for individual graphs.
large grid paper for class graph
mirrors
Student Page 3.6.2 TOOTH CHART

PRODUCTS

Graphs of personal and class tooth data
Completed Student Pages

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PROCEDURES

1. **Introduce the annual tooth inventory to the class.**

   Ask such questions as these:

   - How many teeth do you think you have now?
   - Has anybody lost a tooth?
   - Which teeth have you lost?

2. **Review the tooth inventory techniques with the students.**

   Have them

   - Use Student Page 3.6.2 TOOTH CHART.
   - Circle the corresponding picture of each new tooth that they find.
   - Blacken in any missing teeth.
   - Put an X on all teeth that have cavities, fillings, or caps.
   - Record their total numbers of teeth present, new teeth, and missing teeth.

3. **Have the students verify each other's observations.**

4. **Collect class data.**

   Ask such questions as these:

   - How many teeth do you now have in your jaws?
   - How many teeth have you lost? Have you gained any new teeth?
   - What is the size of the new teeth compared to the size of the old teeth?
   - How many cavities have you now? How many did you have last year?
   - How many cavities do you have in new teeth? How many did you have in new teeth last year?

- How many cavities do you have in old teeth? How many did you have last year?

5. **Summarize the activity by having the students make graphs of personal and class data on their number of teeth. See Figure 3.6.2 Sample Tooth Graphs.**

6. **Review good tooth care practices and procedures with the class.**

EXTENSIONS

Have the students

- Make a large labeled diagram of teeth.
- Invite a dental hygienist to talk to the class about proper tooth care.
- Invent aphorisms and make posters about good tooth care.
- Graph personal and class data on cavities, new teeth, and missing teeth.

ILLUSTRATIONS

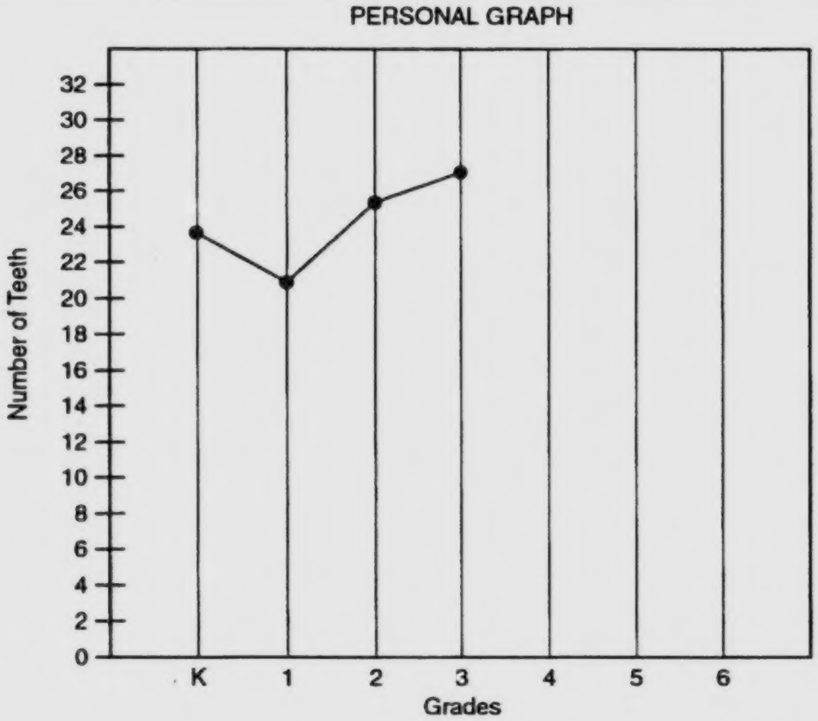

Figure 3.6.2 Sample Tooth Graphs

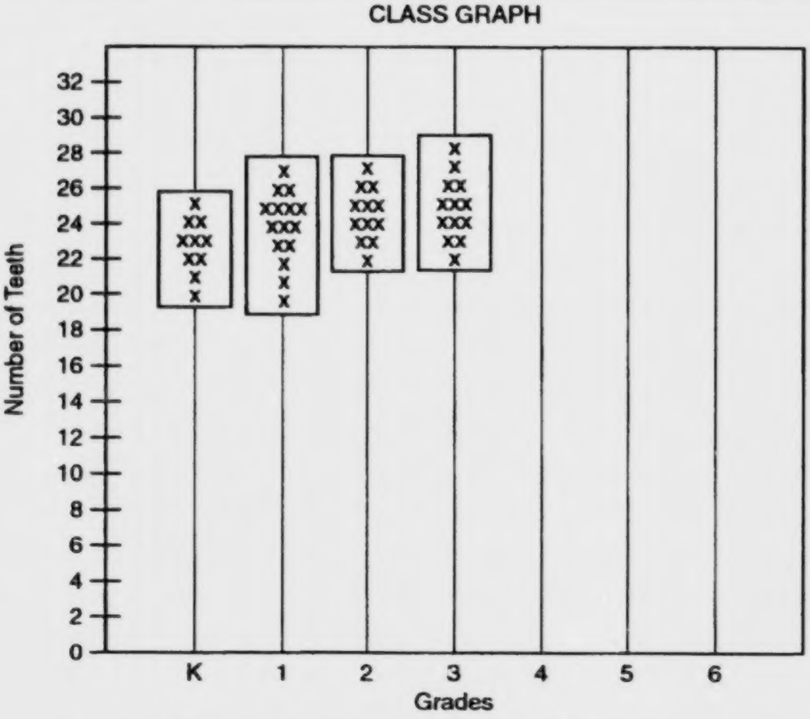

Figure 3.6.2 Sample Tooth Graphs

3.6.3 BREATHING AIR

OBJECTIVES

The students
- Make a concept map about breathing.
- Observe how they breathe.
- Invent ways to demonstrate the breathing process.
- Test for some of the components in the air they exhale.

BACKGROUND

This activity is the first in a series that investigates the heart and lungs. The students begin by making a concept map about breathing and then observe their own breathing. They invent ways to show that air is inhaled and exhaled from their bodies. They use the air-breathing device shown in Figure 3.6.3 to further demonstrate this process. It is important to keep the water level in the two jars equal to prevent the water from siphoning between them.

The students suggest possible components that might be found in the air they exhale. Cobalt chloride paper is used to test the condensation on a mirror for water. Limewater or bromothymol blue solution are used to test for carbon dioxide.

Limewater can be made by adding a heaping tablespoon of builders' lime or calcium oxide (CaO) to 3 cups of water in a quart jar. Put the lid on tightly and shake well. Let the excess powder settle to the bottom. Pour off the clear liquid (limewater) from the top.

To test for carbon dioxide (CO_2), have the students exhale gently through a straw into the limewater. If a white precipitate forms, carbon dioxide is present. The precipitate is calcium carbonate ($CaCO_3$).

To use bromothymol blue solution (Btb) as an indicator for carbon dioxide, place a few drops of the Btb in a cup half-filled with water. Have the students exhale gently through a straw into the cup. If the blue liquid turns yellowish, carbon dioxide is present.

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When the students test the volume of air in their lungs, have them completely fill the first jar with water. This investigation will require two one-gallon or larger jars. The hole in the lid should be slightly smaller than the tubing to ensure an airtight fit. See Figure 3.6.3 Air-breathing Device.

The students revise and add to the ideas on their concept map to summarize what they have learned about the breathing process.

STUDENT ROLE

Physiologist

MATERIALS

chart paper
markers
balloons
bags
2 one-gallon jars, 1 with a lid
drill to make holes in the lid
tubing
clay or sealing material
masking tape
permanent fine-line marker
builder's lime or calcium oxide (CaO)
water
food coloring (optional)
straws
clear plastic cups
bromothymol blue solution or limewater
bubble devices
cobalt chloride paper
litmus paper (optional)
mirrors
Wonder and Discover Book
Student Page 3.6.3 EXHALING

PRODUCTS

Concept map about breathing
Completed Student Pages

PROCEDURES

1. **Have the students make a concept map about breathing. Have them observe themselves breathing.**

   Ask such questions as these:
   - What seems to happen in your body when you breathe?
   - What is breathing?
   - What is a breath?
     ✔ Get at the idea that one breath is a single inhalation and the following exhalation.
   - What do you breathe?
   - Can you invent a way of showing that you take air in and out of your body as you breathe?

2. **Have the students work in groups to invent and demonstrate ways to show that air enters and leaves their bodies as they breathe.**

3. **Introduce the air-breathing device. (See Figure 3.6.3) Have one student inhale through the air-breathing device while another student keeps the water level in the two jars equal to prevent siphoning.**

   Ask such questions as these:
   - How does this device work?
   - How can you show that air is leaving the device?
     ✔ The water level in the first jar rises.
   - How do you know that air is entering your body from the device?
     ✔ It can be felt.
   - Can anyone use this device to also show that air leaves your body when you breathe?

4. **Have a student demonstrate how the air-breathing device can be used to show exhalation while another student keeps the water level in the two jars equal.**

   Ask such questions as these:
   - How does the device work to show exhalation?

- What do you think the gas that leaves our bodies is like?

- Do you think it is different from the air you breathe into your body?
  ✔ Have the students discuss their ideas.

- What happens to your breath when you exhale outside on a cold day? Against a mirror?
  ✔ If possible, have the students observe their breath outside in the cold and against a mirror.

- What happened?

- What seems to form?

- How could you test your ideas?

5. **Have the students discuss how the air-breathing device could be used to measure the volume of air exhaled. Have them invent a way to test their lung capacity.**

6. **Have the class start a list of what they think is in the exhaled gas from their lungs.**

7. **Have the students use cobalt chloride paper to test for water in the condensation formed when they exhale against a mirror. Have them use Student Page 3.6.3 EXHALING to record their observations.**

   Ask such questions as these:
   - What does the fog on the mirror seem to be?

   - How do you know?

   - How do you know that the moisture comes from your lungs and not the air?
     ✔ Work toward the idea that if the moisture came from the air, the mirror would have been moist before they exhaled against it.

   - What else could you test for in the air you exhale?

8. **Introduce the class to the use of bromothymol blue solution (Btb) or limewater as a test or indicator for carbon dioxide. Have each student exhale gently into the solution through a straw. Have the students use Student Page 3.6.3 EXHALING to record their observations.**

   Ask such questions as these:

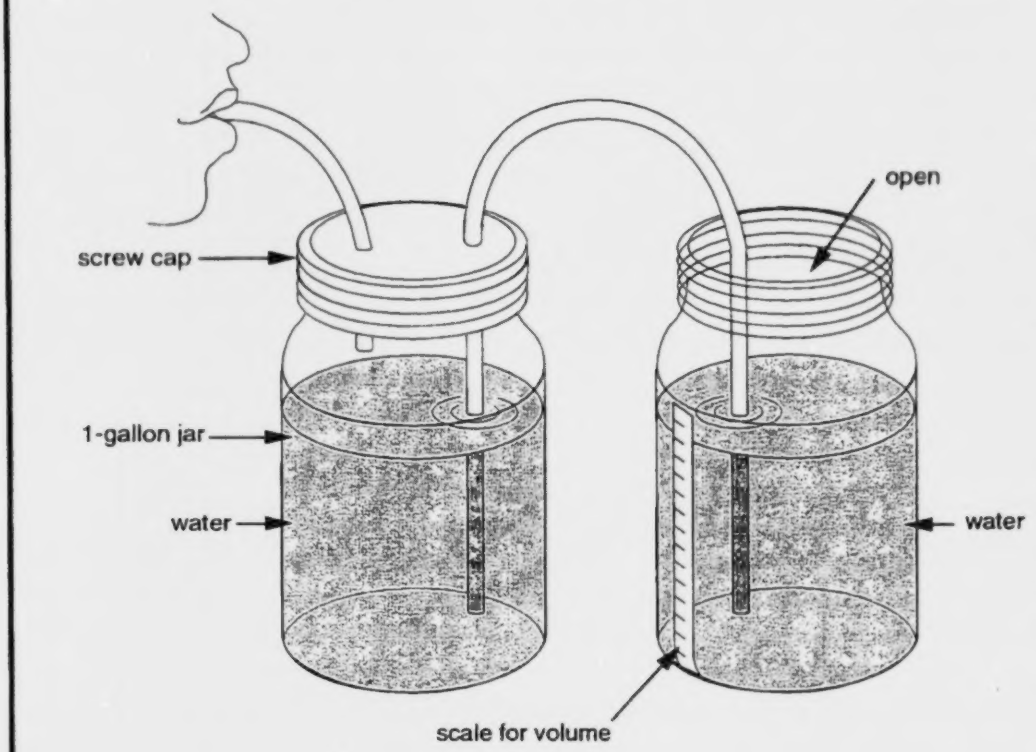
   - What else besides water seems to be in the air you exhale?
   - What happened to the bromothymol blue solution?
   - What happened to the limewater?
   - What is a **precipitate**?
   - How could you find out whether the CO_2 came from the air?
     ✔ Have the students invent a way to bubble only air through the Btb or limewater solution. If the water level is increased in the first jar, air will be pushed out through the breathing tube. An aquarium pump can also be used.
   - What else might be in the air you exhale?
   - How could you find out?
     ✔ The Wonder and Discover Book may be used here.

9. **Summarize information on breathing to date by having students add to and revise the ideas on their concept map about breathing.**

EXTENSION

- Have the students investigate their own questions about breathing.

ILLUSTRATION


open
screw cap
1-gallon jar
water
water
scale for volume

Adjust height of water so that it is the same
in both containers (prevents siphoning)

Figure 3.6.3 Air-breathing Device

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3.6.4 ANATOMY OF BREATHING

OBJECTIVES

The students
- Trace the flow of air through their body as they breathe.
- Identify the body parts used to breathe.

BACKGROUND

This activity continues the investigation of the heart and lungs. By using cold air, the students can feel the path of the air as they inhale and exhale. See Figure 3.6.4 The Anatomy of Breathing. This activity is best done on a cold day. For students in warm climates, breathing the cold air from a cafeteria walk-in freezer, a freezer compartment of a refrigerator, or an ice chest will help them feel the path of the air.

If a model of the human torso is not available in the school or from the science resource teacher, a model can usually be borrowed from a middle school or high school science or health teacher. If it is not possible to locate a three-dimensional model, substitute a large diagram or overhead of the internal organs used in the breathing process.

STUDENT ROLE

Physiologist

MATERIALS

cold air
three-dimensional anatomical model of the human torso
Concept map about breathing from Activity 3.6.3 BREATHING AIR
Student Page 3.6.4 BREATHING

PRODUCT

Completed Student Pages

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PROCEDURES

1. **Have the students trace the flow of cold air as they breathe by inhaling and exhaling deeply and rapidly.**

Ask such questions as these:

- Can you feel air enter your nose? How does it feel?
- Can you describe where the air seems to go after it passes through your nostrils?
✔ Work toward getting the students to feel the movement of air through the nasal cavity, to the back of the throat, down the esophagus, through the larynx, down the trachea, and into the lungs. See Figure 3.6.4 The Respiratory System.
- Can you feel where the air seems to go when you breathe through your mouth?
✔ Trace the same path from the back of the mouth to the lungs.
- Can you feel where the air seems to go as it leaves your lungs when you exhale?
✔ Reverse the path.
- What do you feel when you place your hand on your larynx and breathe?
- Can you keep your chest from moving and still breathe? If so, what other part of your body moves?
✔ The students should find that their abdomen rises and falls.
- Can you keep your abdomen from moving and still breathe?
✔ Students will find that their chest can move in place of their abdomen.
- When you breathe quietly, which of these two body parts do you breathe with?
✔ Most students will answer that it is their abdomen.

2. **Use a three-dimensional model of the torso and identify the body parts involved in breathing.**

Have the students

- Trace the passage of air from their nose and mouth into the lungs.

- Identify the body parts by name.
- Find the heart located between the two lungs.
- Observe that the abdomen is covered with muscular tissue and that the chest is shaped by the ribs.
- Compare the structure of the abdomen and chest of the model to that of their own bodies.

3. **Have the students locate and label each of the body parts found on the three-dimensional model on the diagram on Student Page 3.6.4 BREATHING.**

4. **Summarize the activity by having the students add to and revise their concept map about breathing begun in Activity 3.6.3 BREATHING AIR.**

EXTENSION

Have the students research and report on how other animals breathe.

ILLUSTRATION

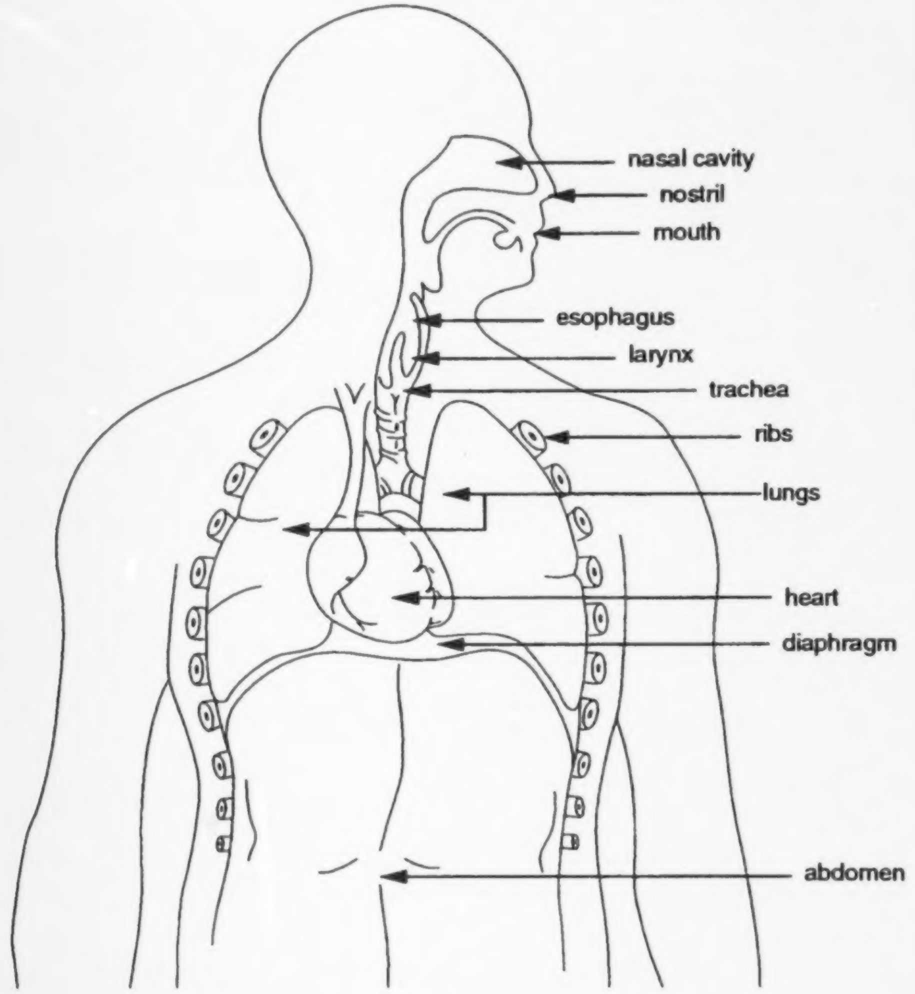
nasal cavity
nostril
mouth
esophagus
larynx
trachea
ribs
lungs
heart
diaphragm
abdomen

Figure 3.6.4 The Respiratory System

3.6.5 LUNG MODEL

OBJECTIVES

The students
- Build a model of the lung.
- Demonstrate how their models work to represent breathing process.

BACKGROUND

In this activity the students investigate the role of the diaphragm in breathing. They build a model of the lung to demonstrate and describe this process. See Figures 3.6.5(1) Chest Cavity and Diaphragm Model and 3.6.5(2) Lung Model.

One- or two-liter plastic soda bottles can be used for the chest cavity. Be sure the plastic bag diaphragm is completely sealed to the bottle with tape. Likewise, the lung or balloon needs to be fully sealed to the straw or trachea. Wide-diameter straws or plastic tubing are the best choices for the trachea if the models are to be used in Activity 3.6.6 LUNGS AND SMOKING.

STUDENT ROLES

Physiologist
Anatomist

MATERIALS

plastic soda bottles (1- or 2-liter)
plastic bags or wrap
clay or soft foam sponge
small balloons
masking or duct tape
plastic tubing or straws
Concept map about breathing from Activity 3.6.3 BREATHING AIR
Student Page 3.6.5 LUNG MODEL

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PRODUCTS

Lung models
Completed Student Pages

PROCEDURES

1. **Have the students review the three-dimensional model of the human torso. Help them see how air is moved into and out of the lungs.**

   Ask such questions as these:
   - How do you think air moves into and out of your lungs?
   - What parts of your body move when you breathe?
   - What part of your body does the abdomen hold?
     ✔ Identify the intestines and stomach.
   - When the muscles in the wall of the abdomen push inward, where might the intestines and stomach go?
     ✔ Help the students see that they push up against the diaphragm which in turn pushes against the lungs.
   - When the muscles in the wall of the abdomen relax, what happens to the intestines and stomach?
     ✔ The stomach and intestines push down and out, and the diaphragm comes down.

2. **Introduce the students to a model of the chest and diaphragm with the lungs missing. See Figure 3.6.5(1).**

   Ask such questions as these:
   - What parts of the human body do each of the model's parts correspond to?
     ✔ Help them see that the plastic bottle corresponds to the chest, the plastic sheet to the diaphragm, and the stopper and tube or straw to the trachea.
   - Where might the lungs fit?
   - How could you modify the model to represent the chest, a lung, the diaphragm, and the trachea?

3. **Have student groups use the materials in the Inventor's Box to build lung models. Be sure the Inventor's Box contains balloons.**

4. **Have each group demonstrate how their model works.**

   Ask such questions as these:
   - What happens in the model of the lung when the diaphragm is pulled down?

   - What happens in the model of the lung when the diaphragm is pushed up?

5. **Have the students summarize how air enters and leaves the body using their model and Student Page 3.6.5 LUNG MODEL. Have them revise and add to their concept map about breathing.**

EXTENSION

Have the students report on how other air pumps such as bellows, syringes, or vacuum pumps work.

ILLUSTRATIONS

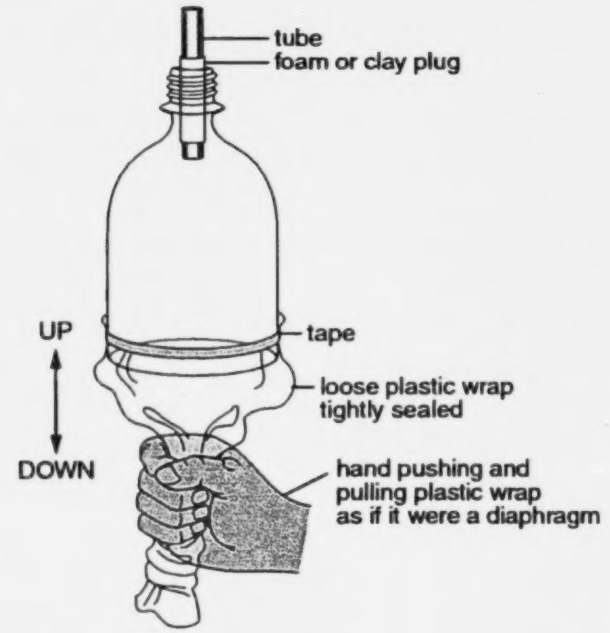
tube
foam or clay plug
UP
DOWN
tape
loose plastic wrap tightly sealed
hand pushing and pulling plastic wrap as if it were a diaphragm

Figure 3.6.5(1) Chest Cavity and Diaphragm Model

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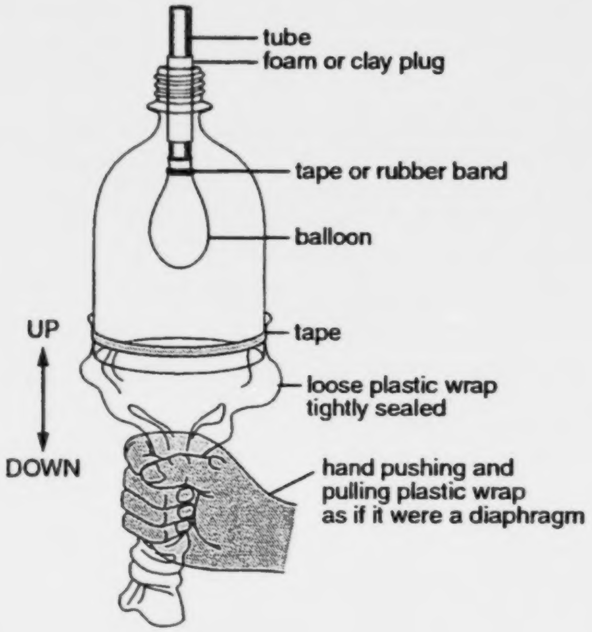
tube
foam or clay plug
tape or rubber band
balloon
UP
tape
loose plastic wrap
tightly sealed
DOWN
hand pushing and
pulling plastic wrap
as if it were a diaphragm

Figure 3.6.5(2) Lung Model

3.6.6 LUNGS AND SMOKING

OBJECTIVES

The students
- Predict what might happen to the lungs of a person who smokes.
- Use their lung models to test their predictions.

BACKGROUND

The students investigate the effect smoking appears to have on the lungs using their lung models made in Activity 3.6.5 LUNG MODEL. This activity should be done outside. Many schools require prior permission to bring cigarettes onto the premises. Non-filtered cigarettes with a high tar content will leave the most residue. Have a few filtered cigarettes available to test the effectiveness of the filter.

Remove the balloon lung before beginning the experiment and reinsert the straw or tubing into the bottle opening. Be sure the opening is completely sealed with clay or a piece of soft foam sponge. See Figure 3.6.6 Cigarette-smoking Machine.

If there is a problem collecting a residue of tar, attach a cotton ball to the straw in place of the lung. Use genuine cotton, not a synthetic.

STUDENT ROLE

Physiologist

MATERIALS

lung models from Activity 3.6.5 LUNG MODEL
clay or soft foam sponge
cotton balls
tape
cigarettes
matches
hand lenses
Concept map about breathing from Activity 3.6.3 BREATHING AIR
Student Page 3.6.6. LUNGS AND SMOKING

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PRODUCT

Completed Student Pages

PROCEDURES

1. **Have the students describe what they think might happen to the lungs when a person smokes.**

   Ask such questions as these:
   - What happens to the lungs of a person who smokes?
   - Does the smoke get all the way into the lungs?
   - How could you show the way lungs work during smoking?

2. **Help the students set up and use their lung models to smoke cigarettes. See Figure 3.6.6 Cigarette Smoking Machine.**

   Ask such questions as these:
   - What did you observe when you simulated the smoking of a cigarette?
   - How would you describe the way the smoke enters the lung model?
   - What does the surface of the plastic bottle look like.
     ✔ Note the deposit of tar on the plastic.
   - How did the model work during the smoking of the cigarette?
   - How might you prevent all that smoke from getting into the lung?
     ✔ Encourage such ideas as using filters and not inhaling as deeply.

3. **Have the students test different ways of reducing the amount of smoke getting into the lung.**

   Ask such questions as these:
   - Did smoke still get into the lung?

- Was there much less smoke?

- What does the inside of the filter look like after the experiment?
  ✔ Have the students open the filter and look at the contents with a hand lens. Have them tape a piece of the filter to Student Page 3.6.6 LUNGS AND SMOKING.

- What does the tar look and smell like?
  ✔ Have the students smear some of the tar on their Student Page and look at it with a hand lens. Be sure they wash their hands thoroughly after doing this.

4. **Have the students attempt to clean their lung models with water and then with soap and water.**

   Ask such questions as these:
   - What is the tar on the plastic like?
   - Can it be easily removed with water?
   - Can it be easily removed with soap and water?
     ✔ Removal of the tar is difficult. The plastic diaphragm will probably have to be replaced.
   - What do you think the lungs of a smoker would look like after smoking for several years?

5. **Summarize the activity by having the students complete Student Page 3.6.6 LUNGS AND SMOKING. Have them revise and add to their concept map about breathing.**

EXTENSIONS

- Invite a representative from the American Cancer Society or another similar organization to speak to the class on the dangers of smoking.

- Show a film or video on the lungs and smoking.

ILLUSTRATION

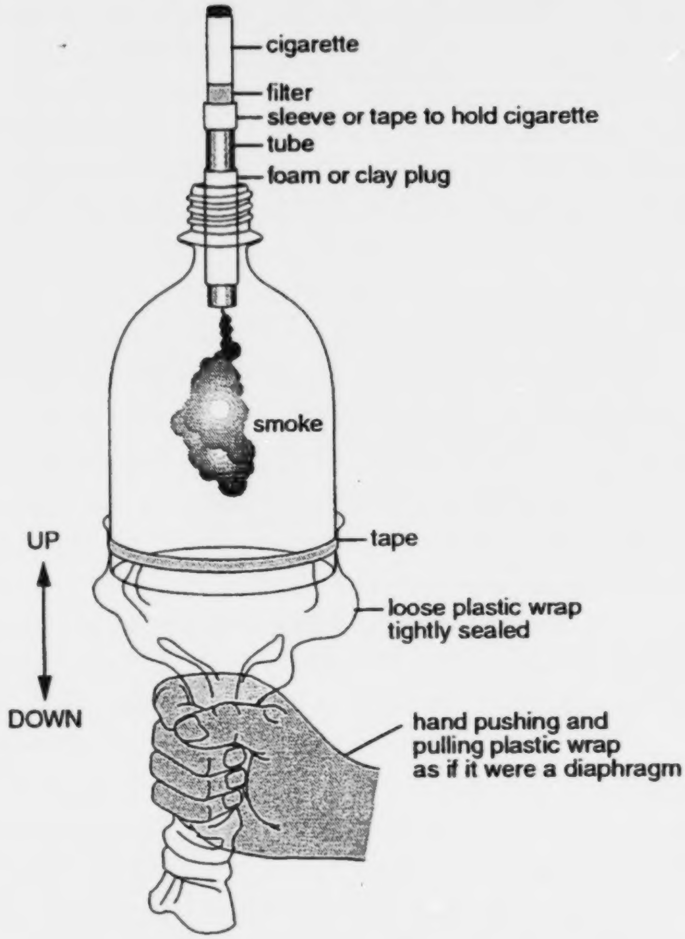
cigarette
filter
sleeve or tape to hold cigarette
tube
foam or clay plug
smoke
UP
DOWN
tape
loose plastic wrap
tightly sealed
hand pushing and
pulling plastic wrap
as if it were a diaphragm

Figure 3.6.6 Cigarette-smoking Machine

DASH 3.6.7 BREATHING AND PULSE RATES

OBJECTIVES

The students
- Identify pulse points on their bodies.
- Observe the changes in the pulse rate as the breathing rate increases.

BACKGROUND

In this activity the students practice taking their pulse and finding their breathing rate. They investigate the connection between these two processes.

The students may need to be introduced to reading seconds on a digital or analog watch or clock. If this is the case, have them observe that there are 60 seconds in a minute and observe the location of the 15- and 30-second points. The use of a watch or clock helps the students develop a sense of time.

STUDENT ROLE

Physiologist

MATERIALS

watch or clock with second hand
markers
grid paper
Student Page 3.6.7 BREATHING AND PULSE RATES

PRODUCTS

Class graph of pulse
Class graph of breathing
Completed Student Pages

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PROCEDURES

1. **Have the students locate pulse points on their own bodies. Introduce the class to the two most common pulse points, the wrist and the throat.**

   Ask such questions as these:
   - Does anyone know what is meant when people say they are going to "take their pulse"?
     ✔ Work toward the idea that it means finding out how many times an artery throbs per minute.

   - Who can find a pulse beat on your wrist?
     ✔ Have the students help each other find a pulse on their wrists.

   - Does anyone know of another place where you can feel your pulse?
     ✔ Have the students locate the spot on their neck, right behind the trachea or windpipe.

2. **Have the students practice taking their own pulse.**

   Have them
   - Count their pulse beats for 30 seconds.

   - Predict how many pulse beats they would have in a minute or 60 seconds.

   - Check their predictions by counting their pulse beats for a full minute.

   - Suggest reasons their predictions were or were not close.

3. **Have the students take their pulse while relaxing and after exercising.**

   Have them
   - Use Student Page 3.6.7 BREATHING AND PULSE RATES to record their data.

- Practice relaxing by
  1. Placing their hands in their laps.
  2. Closing their eyes.
  3. Leaning their head forward.
  4. Inhaling slowly for a count of 6 seconds.
  5. Exhaling slowly for a count of 6 seconds.
  6. Continuing to breathe like this for 2-3 minutes.

- Take each other's pulse for one minute while they are relaxed.

- Do light exercise by walking once around the room.

- Take each other's pulse for one minute.

- Do heavy exercise by running once around the playground.

- Take each other's pulse for one minute.

4. **Have the students make a class graph showing the range of the class data on pulse rate. See Figure 3.6.7 Sample Graphs Showing the Range of Class Data.**

   Have them
   - Each make marks on the lines showing their pulse rates when they are relaxed, after light exercise, and after heavy exercise.

   - Draw a box around all the class data points for each set of data.

5. **Have the students count their number of breaths per minute under the same conditions of relaxing and exercising that they used to measure their pulse rates.**

   Have them
   - Use Student Page 3.6.7 BREATHING AND PULSE RATES to collect their data.

   - Count the number of breaths taken in one minute while they are relaxed.

   - Do light exercise by walking once around the room.

   - Count the number of breaths taken in one minute.

   - Do heavy exercise by running once around the playground.

- Count the number of breaths taken in one minute.
- Make a class graph showing the range of the class data for breathing rate. See Procedure 4.

6. **Summarize the activity by having the students compare their breathing rate with their pulse rate.**

Ask such questions as these:

- What happens to your pulse rate as you become more active?
- Does everyone have about the same pulse rate for the same activity?
- What is the range of pulse beats for different amounts of activity?
- What is the most common pulse rate for different amounts of activity?
- What happens to the number of breaths you take in a minute as you become more active?
- What is the total range of breaths for the class for each different amount of activity?
- What is the most common number of breaths taken each minute for different amounts of activity?
- How are changes in the rates of heartbeat and breathing similar as you increase activity?
- How are changes in the rates of heartbeat and breathing similar as you decrease activity?

EXTENSIONS

Have the students

- Suggest and discuss other times when their breathing and pulse rates might be different from the ones they have investigated so far.
- Keep records of these rates and record them on a Class Breathing and Pulse Chart.

ILLUSTRATION

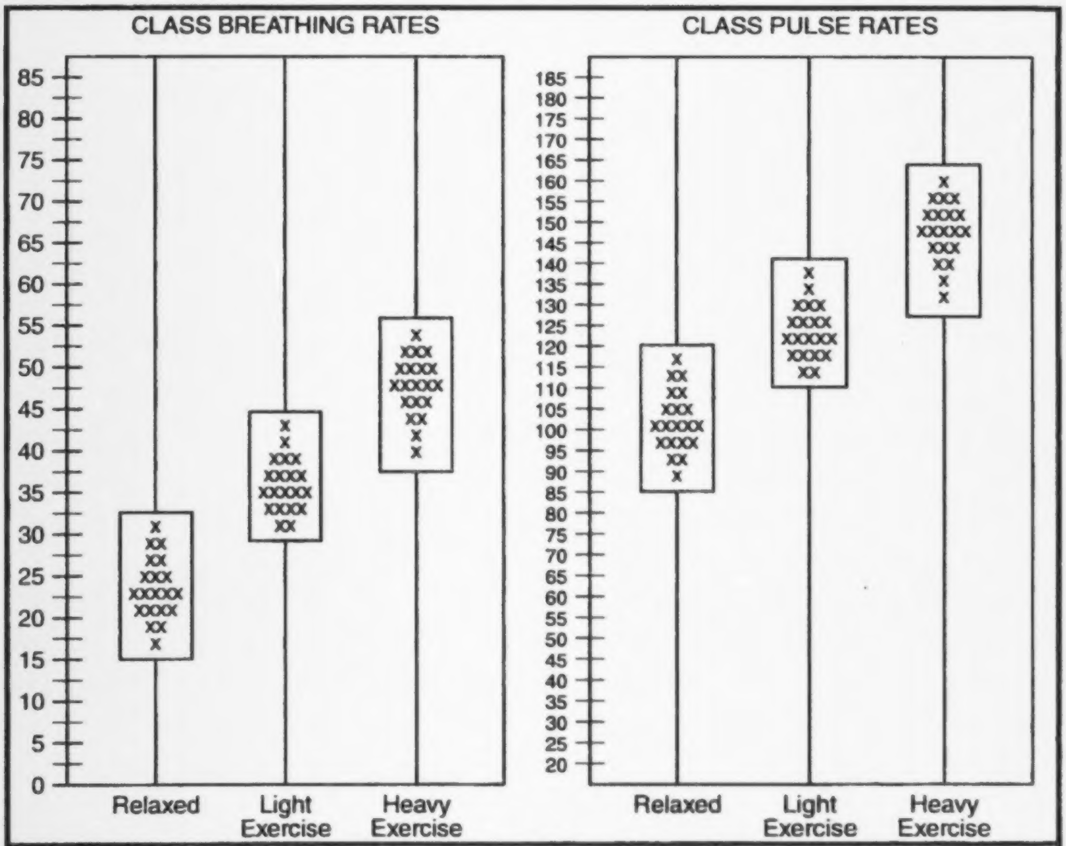

Figure 3.6.7 Sample Graphs Showing the Range of Class Data

3.6.8 HEART, VEINS, AND ARTERIES

OBJECTIVES

The students
- Make a stethoscope.
- Listen to their heart using a stethoscope.
- Use models to trace the flow of blood through their body.
- Take THE AMAZING HEART, ARTERY, AND VEIN QUIZ.

BACKGROUND

In this activity the students investigate the connection between pulse beats and heartbeats using stethoscopes they have invented. See Figure 3.6.8 for some suggestions. Hold the funnel or cone tightly against the chest for best results. The ear can also be put directly against the chest.

Humans at birth have a heartbeat of around 140 beats per minute. By the age of one year the rate has reduced to 120, by the age of ten it is down to 90, and by adulthood the average is 70 beats per minute. Smaller animals have a greater heart rate than larger ones. Mice hearts beat 1,000 times per minute while an elephant heart beats only around 28. Athletes' hearts beat 10–20 fewer times per minute than non-athletes.

A three-dimensional model of the human torso is used to introduce the circulatory system. If a torso is not available from the local middle or high school, a large poster may be used.

Further information about the circulatory system is provided in the summary part of the activity, THE AMAZING HEART, ARTERY, AND VEIN QUIZ. The standard answers for the quiz are given in the Teacher Guide at the end of this activity. This quiz is intended to provide information to the students, not to be used as an evaluation.

STUDENT ROLES

Physiologist
Medical artist

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MATERIALS

plastic aquarium tubing
small funnels
heavy paper or oak tag
stethoscopes (optional)
watch or clock with second hand
red and blue crayons or colored pencils
Student Pages 3.6.8A HEART, VEINS, AND ARTERIES
3.6.8B THE AMAZING HEART, ARTERY, AND VEIN QUIZ

PRODUCTS

Listening devices
Completed Student Pages

PROCEDURES

1. **Have student groups invent stethoscopes from materials found in the Inventor's Box. See Figure 3.6.8(1) Suggested Listening Devices.**

2. **Have the students listen to their own hearts using their stethoscopes.**

   Ask such questions as these:
   - Can anyone describe what the heart sounds like?

   - Listen again. Does your heart sound like the description we just heard?

   - What does a heartbeat seem to be?
     ✔ Help the students notice that there are two distinct sounds, like "lub-dub" followed by a pause, then another "lub-dub" followed by a pause. Work toward agreement that a heartbeat is a "lub-dub" and a pause.

   - How often do you think that your heart will beat in a minute when you are relaxed?

3. **Have a student lead the class in the relaxing exercise introduced in Procedure 3 in Activity 3.6.7 BREATHING AND PULSE RATES.**

Have the students

- Measure how many times their heart beats in a minute while they are relaxed.

- Collect and record the numbers of beats on the board or on chart paper.
  ✔ Work with students who report heartbeats of over 100 to see whether they have measured correctly. You can take their right wrist pulse at the same time they are listening to their heartbeats.

- Make a graph showing the range of the class data.

4. Have the class discuss and analyze their heartbeat data.

Ask such questions as these:

- What is the range of heartbeats per minute?
  ✔ The most and least.

- What is the most common number of heartbeats per minute?

- Have you seen data like these before? If so, where?
  ✔ Work toward the idea that they are like the data they collected on pulse rate when relaxing.

- Can you feel your heart beat? When?

- Who can feel their heart beat now?

- Where do you have to place your hand to feel it?

- Is there a time when we all might easily feel our hearts?
  ✔ Work toward the idea of increasing heart rate when exercising.

- How might pulse rate and heart rate be related?
  ✔ Accept all hypotheses, but help them include one that suggests that the heartbeat creates the pulse.

- How could you test your hypotheses?
  ✔ Again accept all suggestions, but be sure to mention that heart rate and pulse rate should be taken at the same time and that the pulse beats might be expected to occur at about the same time. If the students have been exercising, they can feel their heart beat with their right hand and feel their pulse in their right wrist with their left hand.

5. **Have the students test their hypotheses after exercising.**

Ask such questions as these:

- Do your heartbeat and pulse seem to work together?

- Do you feel your heart beat at the same time you hear your heart beat?
  ✔ If the students are not finding that the two events occur close together, have them test again.

- Who has ever cut themselves? What happened when you did?
  ✔ Work toward a description of bleeding.

- How do you think the blood got to the cut?

- Has anyone noticed what happens to the back of adults' hands when they put them down at their side?
  ✔ Have the students observe that veins bulge out on the teacher's hands.

- Does this happen to you?
  ✔ Some students may have lost enough baby fat to have visible veins.

- These bulges are made by veins that are tubes or vessels that carry blood in our bodies. Do veins pulse?
  ✔ Have the students check their veins or neighbors' veins for signs of a pulse. None should be found because only arteries pulse.

6. **Show the class a three-dimensional torso and point out the position of the heart. Show the red arteries leading from the heart and the blue veins returning blood to the heart.**

As students observe the torso, ask such questions as

- What happens to the size of the veins and arteries as they get farther from the heart?
  ✔ Help the students to see that they get smaller.

- What happens to the number of veins and arteries as they get farther from the heart?
  ✔ Help them to see that they branch and that there are more of them.

7. **Have the students complete the diagram on Student Page 3.6.8A HEART, VEINS, AND ARTERIES.**

   Have them
   - Complete the picture of the veins and arteries in the body so that it shows the blood going out from the heart through the arteries, down to the wrist, to the hand, and back to the heart through the veins. See Figure 3.6.8(2) Heart, Veins, and Arteries.

   - Use a pencil so that their diagrams can be corrected easily.

8. **Use an overhead projection of the student page to discuss what the students have drawn.**

   Ask such questions as these:
   - Who can show us how they drew the path of the blood from the heart to the hand?

   - Who can show us how they drew the path of the blood so that it returns to the heart?

   - How does your drawing show a path for the return of blood to the heart?

   - Which of the drawings seems to be most reasonable?
     ✔ Get at the idea that if the same blood is to return to the heart, there will have to be a way to move it between the arteries and veins.

   - If blood flows through tubes, what do you think the size of these connecting tubes might be? Why do you think that?
     ✔ This will be a guess on the part of students. However, there is logic to the idea that because blood vessels get smaller and smaller as they get further from the heart, these tubes would be even smaller still.

9. **Have the students revise their drawings and color them using red for arteries and blue for veins.**

10. **Summarize the activity by having the students complete Student Page 3.6.8B THE AMAZING HEART, ARTERY, AND VEIN QUIZ.**

    - Ask one question at a time.

    - Have students suggest answers.

- Encourage the students to give reasons for their answers.
- Accept all suggestions.
- Give them the standard answer to write on the student page.

EXTENSION

- Have the students take THE AMAZING HEART, ARTERY, AND VEIN QUIZ home and share it with their family.

ILLUSTRATIONS

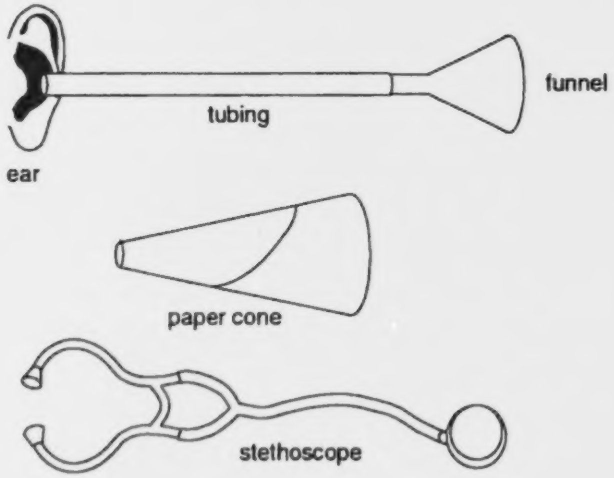
funnel
tubing
ear
paper cone
stethoscope

Figure 3.6.8(1) Suggested Listening Devices

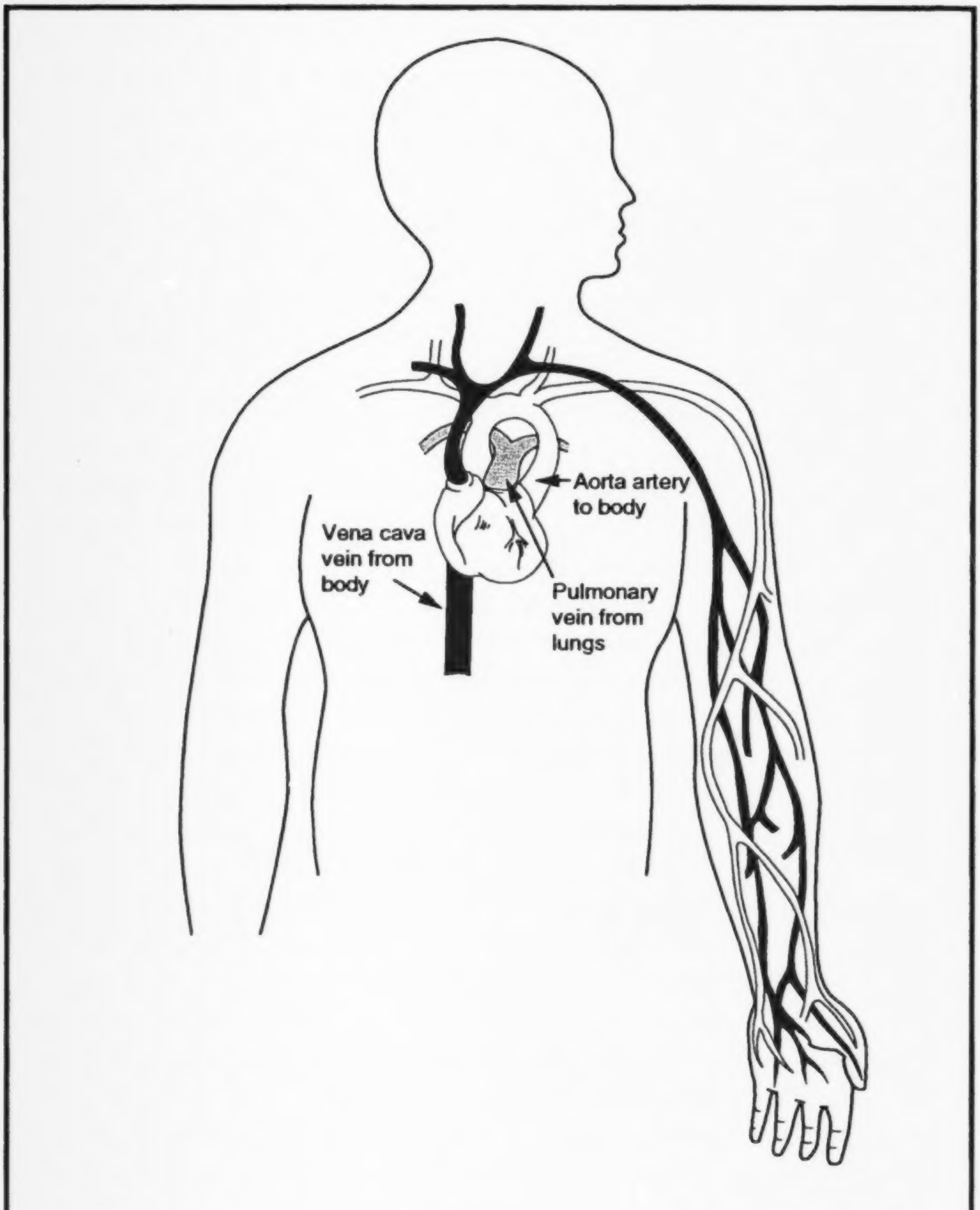
Aorta artery to body
Vena cava vein from body
Pulmonary vein from lungs

Figure 3.6.8(2) Heart, Veins, and Arteries

ANSWERS TO THE AMAZING HEART, ARTERY, AND VEIN QUIZ

1. What pumps blood through your body? (Heart.)
2. How much blood do you have in your body? (4–5 liters.) (That is 4–5 quarts or $2\text{–}2\frac{1}{2}$ half gallons.)
3. How many liters does your heart pump in a minute? ($2\text{–}2\frac{1}{2}$ liters.) How many liters would your heart pump in an hour? (120–150 liters.) How many liters would your heart pump in a day? (2,800–3,600 liters.)
4. What vessels carry blood away from your heart? (Arteries.)
5. What vessels carry your blood back to your heart? (Veins.)
6. What are arteries and veins? (They are tubes called vessels.)
7. How big are arteries and veins? (They range from 3 cm across to as small as 0.2 mm. It takes 5 small arteries or veins to make one millimeter.)
8. How are your arteries and veins connected? (By capillaries.)
9. How long are capillaries? (About 1 mm or the thickness of a dime.)
10. How thick are capillaries? (It would take about 100 side by side to equal one millimeter. They are each $\frac{1}{100}$ of a millimeter.)
11. How many capillaries do you have in your body? (Between 50 and 100 billion or about 10 or 20 times the number of people on earth.)
12. How far would all the capillaries in your body stretch if placed end to end? (Between 50,000 to 100,000 km, 30,000 to 60,000 miles, 12 to 24 times across the United States, or between one and two times around the earth.)
13. What do lungs put into your blood? (The gases from the air.)
14. What do the lungs take out of your blood? (Carbon dioxide and water.)
15. About how many times does your heart beat in an hour? (Between 1,000 and 5,000 times.) About how many times does your heart beat in a day? (Between 96,000 and 120,000 times.)

3.6.9 HEART, LUNGS, AND EXERCISE

OBJECTIVES

The students
- Determine their normal resting breathing rates.
- Determine their normal resting pulse rates.
- Observe how exercise changes breathing and pulse rates.
- Observe the effect of regular exercise on breathing and pulse rates.

BACKGROUND

This activity continues the heart and lungs sequence. It should be started at the beginning of a period of systematic hard physical exercise that will engage the students for 20 minutes or more at least three times a week. Some coordination with the school's physical education teacher may be necessary. After the last day of each workout week, the students record how long it takes their breathing rate to return to normal after 4 minutes of continuous exercise. They also keep data on how fast the pulse rate returns to the resting rate. Each student keeps an on-going graph of their personal data. With the possible exception of those already engaged in regular exercise, the students should show a steady decrease in the time needed to recover from exercise. Strenuous exercise could involve running, jumping, or any intense aerobic activity.

STUDENT ROLE

Exercise physiologist

MATERIALS

watch
calculators (optional)
Student Page 3.6.9 HEART, LUNGS, AND EXERCISE

PRODUCT

Completed Student Pages

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PROCEDURES

1. **Have the students determine their own average breathing rate after they have been sitting quietly or resting for several minutes.**

    Have them
    - Recall what we mean by "breathing rate" from Activity 3.6.7 BREATHING AND PULSE RATES. A breath starts with an inhalation and ends with the last of the following exhalation. **Breathing rate** is the number of breaths per minute.

    - Remain sitting quietly for 2–3 minutes, then determine the number of normal breaths for 2 or 3 minutes.

    - Divide the total number of breaths by the number of minutes. ✔ A calculator may be used.

    - Record this average rate on Student Page 3.6.9 HEART, LUNGS, AND EXERCISE.

2. **Have the students practice determining how long it takes after some brief exercise to restore their breathing rate to that of resting.**

3. **Have the students determine their own average pulse rate after they have been sitting quietly for several minutes.**

    Have them
    - Recall what is meant by "pulse rate" from Activity 3.6.7 BREATHING AND PULSE RATES. **Pulse rate** is the number of beats per minute counted at a pulse point.

    - Remain sitting quietly and count their pulse beats for 60 seconds. Write down the number.

    - Count their pulse beats a second time one minute later. Write this number down also Add the two numbers together.

    - Divide the total number of pulse beats by 2 to find their average pulse rate.
      ✔ A calculator may be used.
      Record this on Student Page 3.6.9 HEART, LUNGS, AND EXERCISE.

4. Have the students practice determining how long it takes to restore their pulse rate after some brief exercise.

5. Have the class engage in a strenuous exercise program three or more times a week for a month or longer.

After the last workout day of each week, have the students

- Do four minutes of strenuous exercise.
- Sit quietly until pulse and breathing return to their usual rates.
- Record the amount of time it takes for both their pulse and breathing to return to their usual rates on the graph in Student Page 3.6.9 HEART, LUNGS, AND EXERCISE.
- Repeat this procedure for the duration of the exercise program.

6. Discuss and summarize student findings after a month or more of exercise.

Ask such questions as these:

- Who has seen a change in the amount of time that it takes before their breathing returns to its usual rate?
- Is this happening to anyone else?
  ✔ Ideally, breathing should start to take less time to return to its usual rate as one gets into condition.
- Has anyone seen a change in the amount of time that it takes before your pulse gets back to its usual rate?
- Is this happening to anyone else?
  ✔ Ideally, the pulse, like breathing, should start to take less time to get back to its usual rate as one gets into condition.
- What does this say about exercise?

EXTENSION

- Have students run a similar investigation on how long it takes to stop perspiring after a fixed period of continuous exercise.

3.6.10 DISEASE TRANSMISSION

OBJECTIVES

The students
- Make a concept map about disease transmission.
- Make a growing medium for microorganisms.
- Investigate things that they think might or might not carry microorganisms.
- Discuss the need for an immune system in humans.

BACKGROUND

This activity continues the study of microorganisms started in kindergarten and leads to the next phase of study, the human immune system. It should follow or be done with the series on decomposition and composting, Activities 3.9.1–3.9.6. The students search for things that they think might carry microorganisms and things that might not. They discover that microorganisms, including disease germs, are almost everywhere and that sanitary procedures reduce the number of these organisms. It follows that to fight disease, the body must have a defense mechanism, called an **immune system**, to back up the attempt to keep things clean.

A medium for growing microorganisms can be made by combining a packet of unflavored gelatin and one-half of the water suggested in the instructions on the gelatin package. Be sure to bring the mixture to a boil to sterilize the medium.

When the mixture is cool, pour it into small resealable plastic bags to a depth of about 1 cm or 1/2 inch. Seal the bags. Hold the tops and dip the bags and contents in ice-cold water to quickly solidify the gelatin or refrigerate them in an upright position overnight. Sterile jar lids inside sealable plastic bags can also be used to hold the mixture.

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To start microorganism growth, open the bags and touch the growth medium with an infecting object. Reseal the bags and pin them to a bulletin board using heavy pins. Be careful not to puncture the sealed part of the bags. The bulletin board should be in a warm location to promote growth. To dispose of the bags, put them into a large heavy-duty plastic bag, close the bag securely, and place it in the school trash bin.

STUDENT ROLE

Bacteriologist

MATERIALS

chart paper
markers
water
unflavored gelatin
small heavy-duty resealable plastic bags
heavy pins
pan for mixing the medium
container for ice water
ice
hot plate or other heat source
hot pads
heavy-duty plastic bag for disposal of test bags
Student Page 3.6.10 GERMS

PRODUCTS

Growth medium
Microorganism display
Completed Student Pages

PROCEDURES

1. **Have the students make a concept map about disease transmission.**

   Ask such questions as these:
   - What is a disease?
     ✔ Work toward examples such as colds, flu, pneumonia, bronchitis, and AIDS and synonyms for disease such as sickness and illness.

- What is meant by transmission?
  ✔ Get at the idea of carrying or sending from one place to another, from one person to another, or from a thing to a person.

- What causes diseases?
  ✔ Have them review the idea of germs. Help the students expand their understanding to include microorganisms such as molds, bacteria, viruses, etc.

- Where do you find the germs that make you sick?
  ✔ Accept all answers. This is the lead-in to the investigation.

2. **Have the students discuss ways to find out where germs are found.**

   Ask such questions as these:
   - Have you ever grown microorganisms and germs?
     ✔ Review their experiences with decomposition.

   - From your experience what would be the best thing on which to grow germs?
     ✔ Accept all ideas.

   - What should our germ-growing material have?

   - Should things grow on it quickly or slowly? Why?

   - What color should it be? Why?
     ✔ Work toward clear or white to see things better.

   - Suppose we wanted to know whether freshly opened tuna has germs in it. If we put some tuna on our growth material, what should happen if the tuna does have germs in it?
     ✔ The germs should grow.
     If it has no germs in it?
     ✔ Nothing should grow.

   - What should our growth material be like?
     ✔ Summarize. Germs should grow quickly on it. It should be clear or white. Nothing should grow if germs are not put on it. It should be sterile.

3. **Introduce the class to a growth medium similar to those that bacteriologists use.**

Have the students
- Mix the medium.

- Pour it into resealable plastic bags.

- Solidify it by cooling the bags in ice water.

4. **Have each student group find things that they think might have no microorganisms or germs and things they think might have microorganisms. Have the groups report their selections so that other groups can choose different things to test.**

5. **Have the groups set up their experiment.**

Have them
- Infect their medium by touching the thing they are investigating to it.

- Seal their bags.
  ✔ Check all seals.

- Label each bag with what it has touched, the group name, and the date.

- Pin the bags on a bulletin board in a warm part of the room where they will not be disturbed.
  ✔ Be careful not to put the pin through the sealed part of the bag.

6. **Allow the bags to stand for several days and then have the students inspect them.**

Have the students
- Use Student Page 3.6.10 GERMS to record the thing touched to the media, their predictions, and their observed results.

- Continue to observe and record their findings every two or three days.

- Place the unopened bags in a larger plastic bag for disposal when the experiment is finished.

7. **Summarize the problem of disease transmission with the class.**

Ask such questions as these:

- Where can germs or disease microorganisms be found.
  ✔ Work toward the idea that they can exist almost anywhere.
- How can you reduce the number of microorganisms getting into your body?
  ✔ Discuss such things as washing, drinking water that has been treated by the city, not coughing in people's faces, cooking foods, etc.
- Can you keep all germs from entering your body?
  ✔ Work to the idea of the impossibility of things being completely **sterile** or germ-free in the real world.
- What happens to the germs that do get into your body?
  ✔ Work to the idea that the human body must have an **immune system** to defend itself against germs.

EXTENSIONS

Have the class make a bulletin board display of

- Places where germs can be found.
- Ways to combat germs.

3.6.11 TRASH AND SANITATION

OBJECTIVES

The students

- Investigate above-ground and below-ground decomposition.
- Invent ways to keep trash in place during the experiment.
- Observe above-ground decomposition off campus.
- Compare their observations of above-ground and below-ground decomposition.

BACKGROUND

This activity should be done at the same time as some part of Activity 3.9.5 FALL UNEARTHING AND BURIAL or Activity 3.9.6 SPRING UNEARTHING AND BURIAL. The students further their investigation of decomposition by observing decomposition above ground and comparing it with decomposition below ground.

Permission should be obtained prior to doing above-ground decomposition on the school campus. If this is not possible, the students can investigate the same problems off campus.

The trash can be held down by a cover of chicken wire attached to a wood frame. The students invent and build the cover. It should be securely fastened to the ground.

STUDENT ROLES

Ecologists
Waste management researchers

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MATERIALS

trash
chicken wire
wood
hammer
wire staples
wire cutters
other materials as requested by the students
Student Page 3.6.11 TRASH

PRODUCTS

Trash holder
Completed Student Pages

PROCEDURES

1. **Have the students review their observations from previous years of what happens to trash that is buried. Have them discuss what happens to trash that is scattered on the ground.**

   Ask such questions as these:
   - What happens to trash on a windy day?
   - Where does windblown trash seem to get caught?
   - What happens to food that is smeared on wrappers?
   - How long do food wrappers take to decompose?
   - What happens to plastic in the sun? In the rain?
   - How long does plastic take to decompose?
   - What happens to food garbage?
   - How long does food garbage take to decompose?
   - What happens to paper in the sun and rain?
   - How long does paper take to decompose?
   - What happens to bones?

- How long do bones take to decompose?
- What happens to metals?
- How long does metal take to decompose?
- Do all metals decompose in the same way?

2. **Have the students find a small out-of-the-way area on campus and get permission to use it to study trash left on the surface of the ground.**

3. **Have the students design and invent a way to secure the trash so it will not blow away.**

   Have them
   - Invent ways to identify items that may decompose.
   - Set up a system to periodically observe the items being studied.
   - Make predictions about what they think will happen to the trash.
   - Record their predictions and observations on Student Page 3.6.11 TRASH.

4. **Have the class make a list of their questions about above-ground decomposition.**

   Have student groups
   - Select a question to investigate.
   - Design, set up, and carry out an experiment to answer their question.

5. **Have small student groups periodically observe a site in their neighborhood where above-ground decomposition is occurring.**

6. **Have the groups report and discuss the findings from their observation and experiments.**

7. **Discuss the sanitation problems involved in above-ground decomposition.**

Ask such questions as these:

- Which seems to take longer, above-ground or below-ground decomposition?
- What effect does trash have on the animal population?
- What kinds of animals are attracted to trash?
- What does trash on the ground do to plant growth?
- How does litter make a place look?
- What can be done about litter problems?

EXTENSION

- Have the students organize a school anti-litter campaign.

3.6.12 HELPFUL DRUGS

OBJECTIVES

The students
- Make a concept map about drugs.
- Make a list of questions about therapeutic drugs to ask a pharmacist.
- Take a class field trip to a drugstore or invite a druggist to speak to the class.
- Make a bulletin board display of their questions and answers.

BACKGROUND

This activity emphasizes the positive, medical side of **drugs**. The language of both abused and therapeutic drugs is discussed. Information is gotten directly from a druggist, doctor, or nurse to stress importance.

Several approaches are possible. One is to take the class on a field trip to a drugstore or pharmacy with an on-site discussion of the operation of the drug department. Another suggestion is to invite a druggist, doctor, or nurse to come to the classroom and discuss drugs.

The students begin their study by making a concept map about drugs. This familiarizes the teacher with the language the students know. There is likely to be some confusion in the language students use in talking about drugs. This stems from two problems. First, the language of drugs comes from several different sources, each having its own terms. These sources are federal agencies such as the Food and Drug Administration under the Health and Welfare Department and the Drug Enforcement Administration under the Justice Department, medical professions, drug manufacturers, and home and street language.

The second problem is that many therapeutic drugs are abused and this dual role by the same drug is confusing. Some examples are morphine and barbiturates.

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Some frequently used terms for therapeutic drugs are listed below. The terms in each group are generally used equivalently.

- Medical drugs, therapeutic drugs, legal drugs, and medicines.
- Non-prescription drugs and over-the-counter drugs.
- Prescription drugs, controlled drugs, and scheduled drugs.
- Research drugs. (Drugs not available for prescription.)

Frequently used terms for non-therapeutic drugs are abused drugs, illegal drugs, illicit drugs, recreational drugs, and narcotics. In medicine narcotics are considered to be opium or any of its derivatives. In law they include opiates and cocaine. In common usage, any illegal drug is considered to be a narcotic.

STUDENT ROLES

Doctor
Pharmacist
Drug enforcement agent
Drug enforcement lawyer

MATERIALS

chart paper
markers
Student Page 3.6.12 HELPFUL DRUGS

PRODUCTS

Concept map about drugs
Class list of questions about drugs
Bulletin board display
Completed Student Pages

PROCEDURES

1. Have the class make a concept map about drugs.

Help the students include such things and ideas as

- Pills and liquids.
- Vitamins.
- Prescription.
- Non-prescription.

- Medicines.
- Druggist, pharmacist, doctors, and nurses.
- Cold tablets, penicillin, antibiotic, aspirin, and vaccines.
  ✔ Include any specific medicines the students suggest.
- Disease-fighting.
- Analgesic.
  ✔ to lessen or stop pain
- Antidepressant.
  ✔ mood elevator
- Narcotic.
  ✔ opium and derivatives
- Depressant.
- Stimulants.
- Hallucinogens.
- Cannabis.
  ✔ marijuana derivative
- Controlled substance.
- Abused drugs, illegal substances, recreational drugs.
- Addiction.
- Overdose.
- Marijuana, cocaine, heroin, LSD, glue, and ice.
  ✔ Include current names.
- Pusher and drug dealer.
  ✔ Include current names as suggested by the students.
- Street terminology.

2. **Discuss with the students the need to get an idea of the kinds of drugs that are helpful in treating illness and staying well. Let the class know how they are to get their**

information. (This may involve taking a field trip or listening to a guest speaker.) Have the students make a list of questions they would like to have discussed.

Help them include such questions as

- What are drugs?
- How many drugs do you have in your store?
- What do drugs do in our bodies?
- What words would you use to describe drugs according to use?
- How are the drugs organized for display in your store?
- What drugs can a child buy without a doctor's prescription?
- What drugs can an adult buy without a doctor's prescription?
- What kinds of drugs can be bought only with a prescription?
- Why is a prescription needed?
- What do you do when you fill a prescription?
- What are the different ways that people can take drugs?
- How do people know how much of a drug to take?
- How do people know when to take a drug?
- What should people do when they forget to take a drug?
- What should people know before they take a drug?
- Where can people get information about drugs?
- What should people do with their leftover drugs once they are feeling better?
- Why do the same drugs sometimes have different prices under different brand names?
  ✔ For example, aspirin and vitamins.
- How can people get the cheapest drugs?

- Are cheap drugs as good as high-priced drugs with a different brand name on them?
- What makes a drug illegal?
- Is there a difference between a pharmacist and a druggist?
- How did you become a pharmacist?
- How long does it take to become a pharmacist?

3. **Have the students write a letter to a pharmacist asking to have the class tour a drugstore or to have the pharmacist as a guest speaker. Include the students' questions with the letter, indicating that these are questions the students would like to have discussed.**

4. **Take the class field trip or welcome the speaker.**

   - Assign groups of students to record answers to their questions. Use Student Page 3.6.12 HELPFUL DRUGS.
   - If a question is not answered or is only partly answered in the presentation, a group member should ask it again.
   - Have the students ask any further questions and record these answers.

5. **After the field trip or presentation have the students make a bulletin board display of their questions and answers.**

6. **Have the class add to, revise, and reorganize the concept map about drugs.**

EXTENSION

- Have the students bring in labels from empty medicine containers and make a Class Therapeutic Drug Guide.

  Have them include
  - The name of the drug.
  - Its use.
  - The recommended dosage.

- Limitations for children.
- Side effects.
- What to do in case of an overdose.

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3.6.13 PROPER DRUG USE

OBJECTIVES

The students
- Discuss the proper and improper use of drugs.
- Create aphorisms about how to use drugs properly.

BACKGROUND

This is the second activity on drugs. The students read and discuss stories about proper and improper use of drugs. The stories are found in the Teacher Guide at the end of this activity. The students identify and discuss the improper practices in the stories. They also create aphorisms about the proper use of drugs.

STUDENT ROLES

Writer
Doctor

MATERIALS

stories
Student Page 3.6.13 PROPER DRUG USE

PRODUCTS

Aphorisms
Completed Student Pages

PROCEDURES

1. **Read "Freddie's Story" to the class. Have them discuss it.**

   Ask such questions as these:
   - Why do you think Freddie got sick?
     ✔ Work toward the ideas that he took too many pills at once or that he may have taken the wrong pills.

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- Why shouldn't he have taken three pills all at once?
  ✔ They were supposed to be taken one at a time.

- What could have happened?
  ✔ Possibly in taking three pills rather than one pill he got an overdose or he got the wrong pills.

- How could the accident have been prevented?
  ✔ Sara could have put the pills somewhere other than in the medicine cabinet where they could be confused with other pills. Freddie could have asked how many pills he should have taken. Aunt Liz could have given instructions just in case Freddie forgot to take his pills. The small bottle could have been clearly labeled with Freddie's name and the dose.

- What should Sara have done when Freddie got sick?
  ✔ Probably just what she did.

- Why might the medics ask almost immediately about medicine?
  ✔ Because drug poisoning is one of the most common problems with children.

- What do you think the medics will do?
  ✔ Report to a doctor who may have them pump Freddie's stomach.

2. **Read and discuss "Rajiv's Story" with the class.**

   Ask such questions as these:
   - Why do you think Rajiv got sick?
     ✔ Work toward the idea that what he ate was probably not candy.

   - How could the accident have been prevented?
     ✔ Explore all answers. Include such things as putting medicines in a place different from the one where food is stored and telling Rajiv what was in the jar ahead of time to warn him.

   - What should Rajiv have done when he got sick?
     ✔ Rajiv did the right thing. He tried to get help.

   - What else could Rajiv have done?
     ✔ Phone 911, his mother, or the neighbor across the hall.

3. **Read and discuss "Erin's Story" with the students.**

Ask such questions as these:

- Was Grandma correct in taking Erin to the clinic?
  ✔ Probably. Long-protracted coughing can lead to other complications and weaken the body.

- Why did Grandma stop giving Erin her medicine?
  ✔ She probably thought the coughing was cured.

- Was Grandma right to stop giving Erin the medicine? Why?
  ✔ She was right to stop giving the cough syrup that Erin was to take only until the coughing stopped. She was wrong to stop giving the tablets. One should take all of a prescription unless advised otherwise by the doctor.

- Why do you think Erin started coughing again?
  ✔ Probably the medicine had not been taken long enough for her body to get rid of all the germs causing the strep throat.

- What happens to old medicines?
  ✔ Work toward the idea that they lose their effectiveness.

4. **Read and discuss "Carmen's Story" with the class.**

Ask such questions as these:

- Why did Dr. Roman prescribe aspirin and water?
  ✔ It's a very common treatment for flu.

- Was there a problem in Carmen's father going back to work when he was still feeling sick?
  ✔ He probably could pass the "bug" on to others.

- How old is Carmen?
  ✔ Probably a child if she gets a coloring book as a present.

- How old are Carmen's mother, grandfather, and brother?
  ✔ They are probably adults because they all have jobs.

- Was this treatment safe for other members of her family?
  ✔ Only if they were adults.

- Is there any danger in using the same treatment for other members of the family with similar symptoms?
  ✔ There is always the possibility that someone else may be sensitive to the medicine or may have similar symptoms but a different illness.

- Are there any problems using the same treatment for Carmen?
  ✔ Yes, there is the special problem of young children with flu or chickenpox in taking aspirin. They may get a reaction called **Reye's syndrome**, a disease of childhood with symptoms of high fever, vomiting, and swelling of the kidney and brain sometimes resulting in permanent damage. It is often fatal.

- What should be done?
  ✔ Treatments should be prescribed for each individual by a doctor. Adult treatments should **not** be used on children without consulting with a doctor.

5. **Have the students create aphorisms about the proper use of drugs. Have them make up one aphorism for each of the problems raised in the stories.**

Include such ideas as

- Don't allow children to take medicines from a medicine cabinet.
- Keep medicines away from young children.
- Don't "double up" on medicines when one dose is missed.
- Never take more medicine than is prescribed.
- Call 911 in an emergency.
- Don't store medicine and food in the same place.
- Follow the doctor's instructions.
- Take a medicine for its full prescribed period.
- Don't save prescription medicines.
- Check with the doctor to see whether adult treatments should be used with children.
- Do not give aspirin to children with flu or chickenpox.

EXTENSIONS

Have the students
- Make posters to go with their aphorisms.
- Hang their posters in the hall or on the school bulletin board for other students to see.

ILLUSTRATIONS

FREDDIE'S STORY

Freddie was spending the summer with his Aunt Liz. One day Aunt Liz had to go to Maysville with Uncle Ted. She left Sara, her oldest daughter, in charge of Freddie and the other children, Bruce and Bettyann. Just before she left, Aunt Liz put three pills in a little brown medicine bottle and gave it to Freddie. She reminded him to take one before he ate each meal. Freddie was taking the pills because he had a problem digesting milk even though he really liked it.

At breakfast just as Freddie was about to take the first pill, Mr. Donovan came by to drive him and Bruce to play ball. Freddie forgot all about the pills and left the bottle on the table. When Sara cleaned up the dishes, she put the bottle in the medicine cabinet.

Freddie and Bruce did not get back from the game until late afternoon. At supper Freddie remembered his pills and asked whether anyone had seen them. Sara said she had put them in the medicine cabinet in "Mom and Dad's bathroom." Freddie went to the cabinet, found a brown medicine bottle, poured out three pills, and swallowed them with water. They tasted a little funny.

At the supper table he got really sick. He scared Sara so badly she called 911 for help. The paramedics were there in eight minutes.

They asked Sara questions because Freddie couldn't talk. "Has this happened before?" the taller medic asked.

"I don't know," Sara answered, "He's only visiting."

"Did he take any medicine?"

Sara hesitated. "I told him where I put his milk pills."

"Milk pills?" said the other medic.

"Yes," answered Sara, "Milk makes him sick."

RAJIV'S STORY

When Rajiv gets home from first grade he knocks on Mrs. Swetzler's door. Mrs. Swetzler lives across the hall in apartment 111. Rajiv's mother has arranged for Mrs. Swetzler to open the door to their apartment, number 110, so Rajiv can go in and watch TV. Rajiv always goes inside, locks the door, turns on the TV, and makes a peanut butter sandwich. His mother gets home from work about two hours later.

Today when Rajiv went to get the peanut butter he saw jar of yellow "candies" on the shelf above. This is where his mother keeps thermometers and all sorts of different-sized bottles.

After he made his sandwich, he got the bottle with the yellow candies down and went into the living room to watch TV and eat his snack. The sandwich tasted fine, but the candies were not as sweet as he thought they would be. He ate quite a few anyway.

About ten minutes later Rajiv got very sick. As his mother had told him, he went across to Mrs. Swetzler's and knocked hard on the door.

ERIN'S STORY

Right after Christmas Erin came down with a bad cough. Her grandma said she got it because she didn't keep her coat zipped up during the snowball fight with "those kids on the other side of the street." Whether she was right or not didn't matter much because what Grandma thought didn't help Erin's cough. The cough kept getting worse rather than better, as coughs often do. Erin began to run a bit of a fever.

One morning near the end of Christmas vacation Grandma decided to walk the four and a half blocks with Erin to the clinic. It was cold, windy, and slippery. While crossing 24th Street, Grandma slipped and pulled Erin down with her. They both laughed, but Erin began to cough hard. Grandma pulled herself up and then helped Erin. She said she was glad they were almost at the clinic because "all this cold isn't good for that cough."

At the clinic Grandma checked with the nurse at the desk while Erin sat near the radiator turning the pages of an old golfing magazine. The room was full of people, many of them coughing as hard and often as Erin. Grandma whispered, "You all sound like seals in a zoo."

When they called Erin's name, Grandma went with her. The doctor put a thermometer in Erin's mouth, listened to her chest, looked down her throat, checked the swelling behind her jaw, and peered into her ears. "You've got a bad strep throat," he said. Turning to Grandma, he wrote out a prescription. "She should take one tablet every eight hours. Give Erin two tablespoons of the cough syrup at the same time until the coughing stops. Keep the pills up for a week."

By the third day Erin was coughing only once in a while. By the fourth day the cough was gone. "Good for you," said grandma. "You're all well, and we can save the rest of the pills for the next time you get sick." Three days later Erin had another cough.

CARMEN'S STORY

It was flu season. When Carmen's father returned from his trip he wasn't feeling very well, but he woke Carmen up just long enough to give her a new coloring book and kiss her goodnight. The next day he was really sick. He was nauseous and ran a high fever. He hardly made it to Dr. Roman's office. Dr. Roman told him to go home, rest, drink lots of water, and take aspirin for his fever. The next day he still felt sick, but he went to work anyway.

Within a week Carmen's mother, older brother Manuel, and grandfather came down with the same symptoms. They followed Dr. Roman's advice. They drank lots of water and took aspirin. They missed work for only two or three days.

Then it was Carmen's turn to "get the bug." Her father said, "It's lots of water and aspirin for you, too, Carmencita."

DASH

GROWTH CHART
SP 3.6.1A

Name: ______________________

Date: ______________________

GRADE	DATE	HEIGHT		WEIGHT/MASS		HAND	FOOT
	MO/YR	IN	CM	LB	KG	SQ CM	SQ CM
K							
1							
2							
3							
4							
5							
6							

DASH

HAND AND FOOT
SP 3.6.1B

Name: ____________________

Date: ____________________

DASH

CHANGES IN GROWTH
SP 3.6.1C Page 1

Name: ______________________

Date: ______________________

HEIGHT				CHANGES IN HEIGHT			WEIGHT				CHANGES IN WEIGHT		
DATE	GR	CM	IN	BETWEEN	CM	IN	DATE	GR	KG	LB	BETWEEN	KG	LB
				*1–K							*1–K		
				2–1							2–1		
				3–2							3–2		
				4–3							4–3		
				5–4							5–4		
				6–5							6–5		
				**1–☐							**1–☐		
				2–☐							2–☐		
				3–☐							3–☐		
				4–☐							4–☐		
				5–☐							5–☐		
				6–☐							6–☐		

* Gives the change in height or weight from one year to the next. Use the first measurement taken each year.

** Gives the change in height or weight once measurements were first made. Use the first measurement taken each year.

Fill in the ☐ with the earliest grade in which these measurements were taken.

DASH

CHANGES IN GROWTH
SP 3.6.1C Page 2

Name: ______________________

Date: ______________________

HAND AND FOOT AREA

HAND					FOOT				
MEASUREMENT			CHANGE		MEASUREMENT			CHANGE	
DATE	GR	CM^2	BETWEEN	CM^2	DATE	GR	CM^2	BETWEEN	CM^2
			*1–K					*1–K	
			2–1					2–1	
			3–2					3–2	
			4–3					4–3	
			5–4					5–4	
			6–5					6–5	
			**1–☐					**1–☐	
			2–☐					2–☐	
			3–☐					3–☐	
			4–☐					4–☐	
			5–☐					5–☐	
			6–☐					6–☐	

* Gives the change in hand or foot area from one year to the next. Use the first measurement taken each year.

** Gives the change in hand or foot area since measurements were first made. Use the first measurement taken each year.

Fill in the ☐ with the earliest grade in which these measurements were taken.

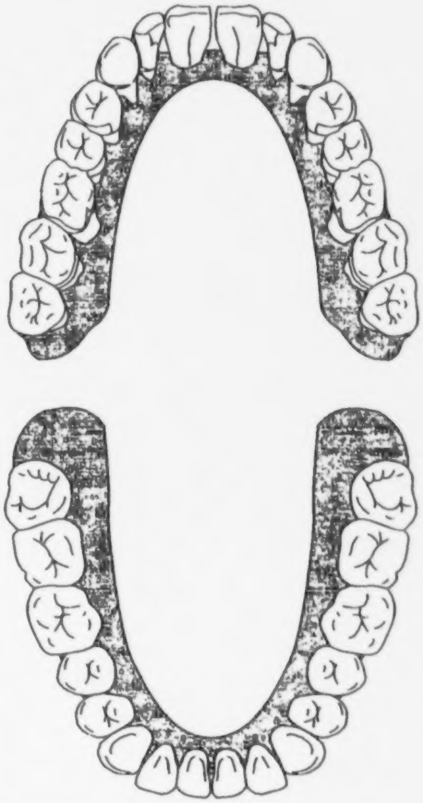
DASH

TOOTH CHART
SP 3.6.2

Name: ____________________

Date: ____________________

Blacken any missing teeth.
Circle any new teeth.
Put an "X" on any teeth with cavities, fillings, or caps.



How many teeth do you have? ☐
How many teeth have you lost? ☐
How many new teeth do you have? ☐

DASH

EXHALING
SP 3.6.3

Name: ______________________

Date: ______________________

SUBSTANCE TO TEST FOR	INDICATOR OR TEST	OBSERVATIONS

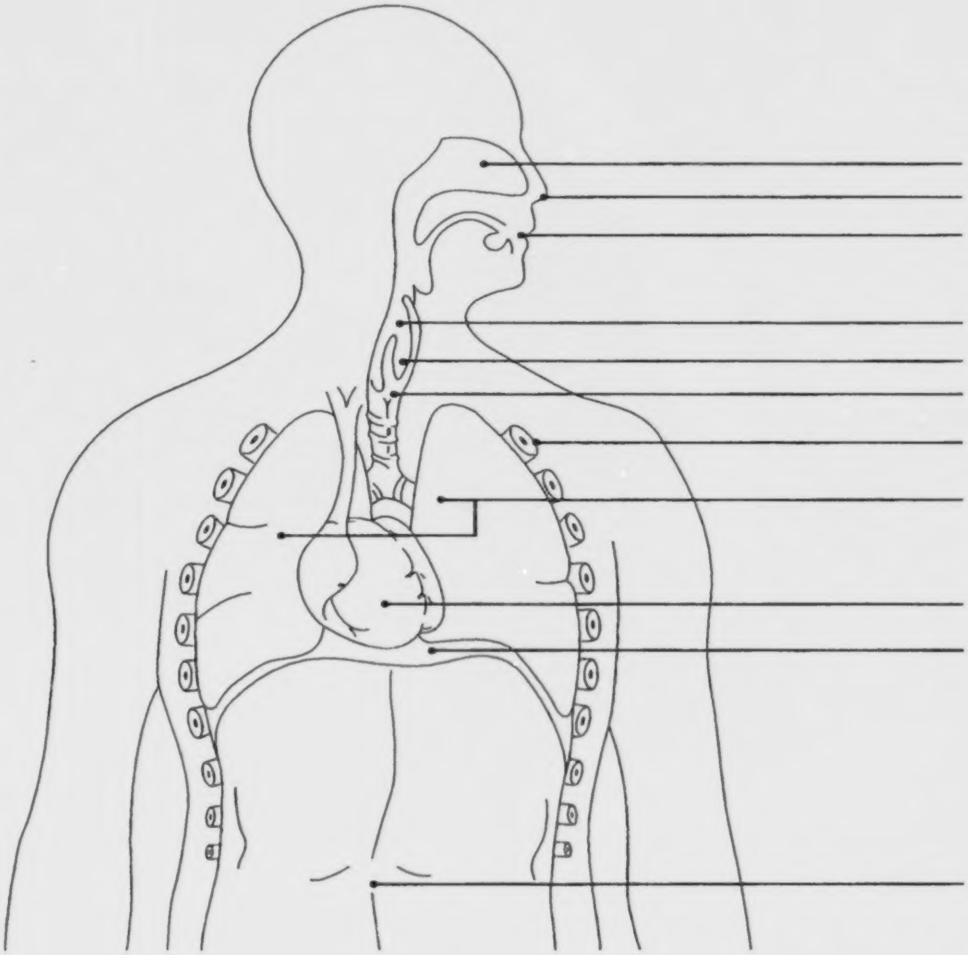
DASH

BREATHING
SP 3.6.4

Name: ______________________

Date: ______________________

Label the diagram with the words below.



BODY PARTS

Lungs
Nostril
Abdomen

Diaphragm
Trachea
Esophagus

Larynx
Nasal Cavity
Mouth

Chest
Heart

DASH

LUNG MODEL
SP 3.6.5

Name: ______________________

Date: ______________________

Draw and label a picture of your lung model.

Describe or draw and label pictures to explain how your model is like your lungs.

DASH

LUNGS AND SMOKING
SP 3.6.6

Name: ______________________

Date: ______________________

Draw and label the lung model used to show what happens to the lungs of a smoker.

Describe what happened to your lung model during smoking.

____

____

____

____

____

Attach and label your smoking samples here. Describe how they looked through a hand lens.

BREATHING AND PULSE RATES SP 3.6.7

Name: ______________________

Date: ______________________

Draw and label the places on your body where you could feel your pulse.

COUNTED PULSE BEATS FOR 30 SECONDS	PREDICTED PULSE BEATS FOR 60 SECONDS	COUNTED PULSE BEATS FOR 60 SECONDS

KIND OF ACTIVITY	PULSE BEATS COUNTED IN A MINUTE	BREATHS COUNTED IN A MINUTE
Relaxed		
Light Exercise		
Heavy Exercise		

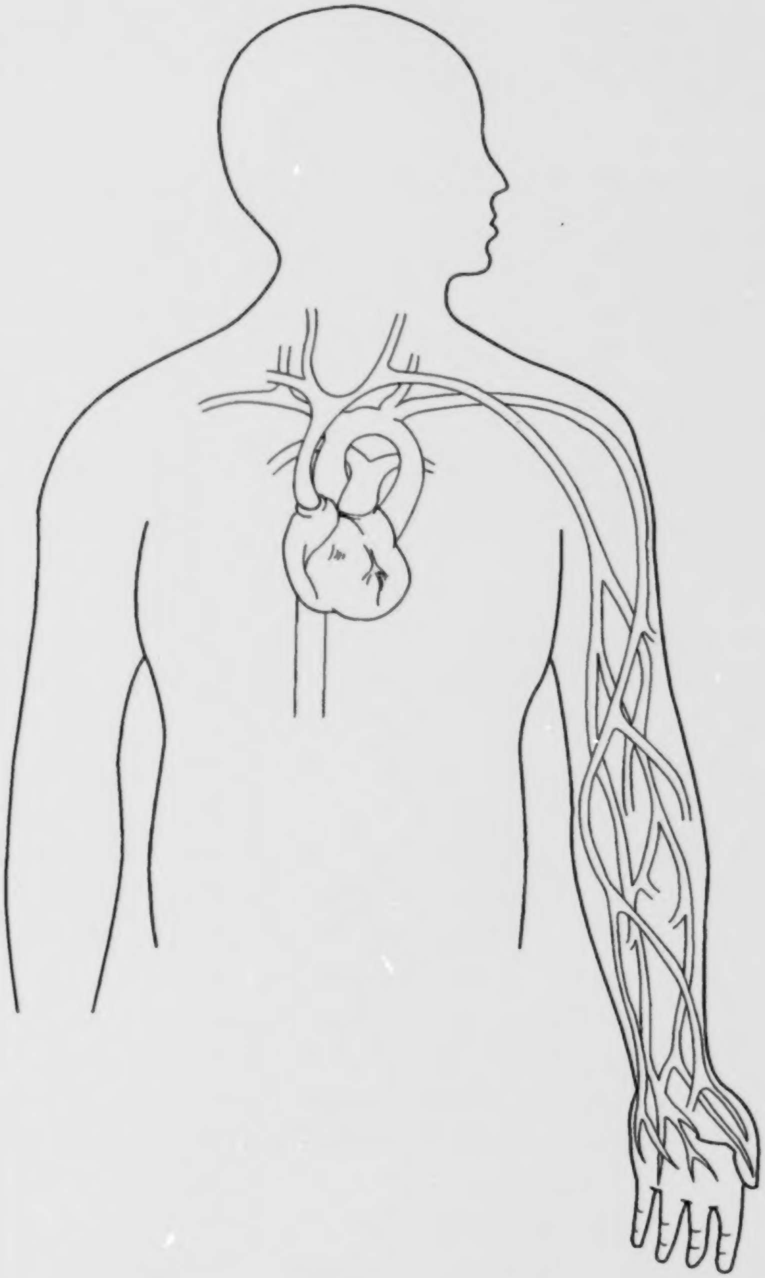
DASH

HEART, VEINS, AND ARTERIES
SP 3.6.8A

Name: ____________________

Date: ____________________

Complete the picture using red for arteries and blue for veins.



DASH

THE AMAZING HEART, ARTERY, AND VEIN QUIZ
SP 3.6.8B

Name: ____________________

Date: ____________________

1. What pumps blood through your body? ____________________

2. How much blood do you have in your body? ________ liters or ________ quarts or ________ half gallons

3. How many liters does your heart pump in a minute? ____________ liters
How many liters would your heart pump in an hour? ____________ liters
How many liters would your heart pump in a day? ____________ liters

4. What vessels carry blood away from your heart? ____________________

5. What vessels carry your blood back to your heart? ____________________

6. What are arteries and veins? ____________________

7. How big are arteries and veins? ____________________

8. How are your arteries and veins connected? ____________________

9. How long are capillaries? ____________________

10. How thick are capillaries? ____________________

11. How many capillaries do you have in your body? ____________________

12. How far would all the capillaries in your body stretch if placed end to end? ________ ____________________

13. What do the lungs put into your blood? ____________________

14. What do the lungs take out of your blood? ____________ and ____________

15. About how many times does your heart beat in an hour? ____________
About how many times does your heart beat in a day? ____________

SP 3.6.9

DASH

HEART, LUNGS, AND EXERCISE
SP 3.6.9

Name: ____________________

Date: ____________________

Average breaths per minute when sitting quietly:

Average pulse beats per minute when sitting quietly:

Record the amount of time it takes for your breathing and pulse rates to return to their usual rates. On the graph below, use red dots for pulse beats and blue dots for breaths. Connect your red dots with red lines. Connect your blue dots with blue lines.

TIME	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6
11 min.						
10 min.						
9 min.						
8 min.						
7 min.						
6 min.						
5 min.						
4 min.						
3 min.						
2 min.						
1 min.						
0 min.						

DASH

GERMS
SP 3.6.10

Name: ____________________

Date: ____________________

Investigators:
Date of Infection:
Thing Touched to the Growth Medium:
PREDICTIONS

DATE	OBSERVATIONS

DASH

TRASH
SP 3.6.11

Name: ____________________

Date: ____________________

OBSERVATIONS	DATE:	
	DATE:	
	DATE:	
	DATE:	
	DATE:	
PREDICTIONS		
KIND OF TRASH		

DASH

HELPFUL DRUGS SP 3.6.12

Name: ____________________

Date: ____________________

Question:
Answer:
Question:
Answer:
Question:
Answer:
Question:
Answer:

DASH

PROPER DRUG USE APHORISMS
SP 3.6.13

Name: ______________________

Date: ______________________

APHORISM	WHAT IT MEANS

DASH

GRADE THREE
CLUSTER 7

WAYFINDING AND TRANSPORTATION

3.7.1 Garden Mover
3.7.2 Propeller-Driven Message Center
3.7.3 Propeller-Driven Boat
3.7.4 Delivery Systems

3.7.1 GARDEN MOVER

OBJECTIVES

The students
- Invent a way to move their garden into the sunlight.
- Invent and construct a garden mover.

BACKGROUND

This project is a part of the grade three gardening activities. It is used if it is impossible to grow the garden outside. The students invent a way to move their garden into the sunlight. They build and use a garden mover.

STUDENT ROLES

Inventor
Engineer

MATERIALS

wood scraps
wheels
dowels
nails
screws
nuts and bolts
other materials as requested
saws
hammers
drills
pliers
wrenches
screw drivers
other tools as requested
Student Page 3.7.1 GARDEN MOVER

PRODUCTS

Garden mover
Completed Student Pages

PROCEDURES

1. **Have the class discuss ways to provide sunlight for the garden.**

   Help them to include such ideas as
   - Ways to move the garden easily.
   - Ways to support the bottom of the garden.
   - Size dimensions that will allow the garden to pass through doors to the outside.
   - Ways to keep the garden from moving when it is in position.
   - Systems that are easy to construct.
   - Systems that use recycled materials.
   - Alternative light sources.

2. **Have student groups design garden movers.**

   Have them
   - Make drawings of their designs including the dimensions and materials needed on SP 2.7.1 GARDEN MOVER.
   - Discuss and record where they could get the materials they will need.
   - Make a list of the tools they will need.
   - Report on their design and its advantages.

3. **Have the class discuss the advantages and disadvantages of each garden mover design.**

   Have them
   - Decide on the best overall design.

- Decide who will build the garden mover.

4. **Have the students construct the garden mover and modify it as necessary.**

5. **When the garden mover is no longer needed have the class discuss the project.**

   Help them include such ideas as
   - Good features of the design.
   - Unsatisfactory or inconvenient features of the design.
   - Ways they would modify the design if they made another garden mover.
   - Other movers or transporters they have observed and how they are alike and different.

EXTENSIONS

- Have the students make drawings of other movers or transporters that they find that serve the same function as their garden transporter.
- Have them make a display of their drawings.

3.7.2 PROPELLER-DRIVEN MESSAGE CENTER

OBJECTIVES

The students
- Explore using a propeller to invent a transport system.
- Construct a propeller-driven message carrier.

BACKGROUND

This activity explores the use of a propeller to drive an aerial transport system. The students invent a string message-carrying system. This activity follows the propeller investigations in Activities 3.8.3-3.8.5. It is easily incorporated into the Supermarket Game for sending messages between groups.

STUDENT ROLE

Inventor

MATERIALS

propeller-making materials from Activity 3.8.3 WIND PULLS AND PUSHES
large rubber bands
string
straws
large paper clips
Student Page 3.7.2 PROPELLER-DRIVEN MESSAGE CARRIER

PRODUCTS

Message carriers
Completed Student Pages

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PROCEDURES

1. **Introduce the activity by stating the need to invent ways to carry messages. Have the students discuss ways to use a propeller to move a message carrier along a string.**

2. **Have student groups design propeller-driven message carriers. Have them record their inventions on Student Page 3.7.2 PROPELLER-DRIVEN MESSAGE CARRIER.**

3. **Have the groups build and test their carriers.**

4. **Have the students discuss and summarize the activity.**

   Ask such questions as these:
   - Which carriers worked better? The best?
   - What are the characteristics of the carriers that performed better? Best?
   - What other characteristics did we consider when we said it performed better?
   - What operating problems had to be overcome?
   - What was the condition of the string when the carriers worked best?
   - How would you modify your system to make it work better?

EXTENSION

- Have the students research and report on ways propellers other than on airplanes, are used to move things.

3.7.3 PROPELLER-DRIVEN BOAT

OBJECTIVES

The students
- Invent ways to change air propellers into water propellers.
- Build and race propeller-driven boats.

BACKGROUND

This activity follows Activity 3.7.2 PROPELLER-DRIVEN MESSAGE CARRIER and it precedes 3.8.6 PROPELLERS IN WATER. The students continue to explore the use of propellers in fluids (first a gas, air, and now a liquid, water). The students modify their air propellers to move in water. They build propeller-driven boats applying what they learned in building their message carriers. Then they build a pool and race their boats.

The boats should be about 15 cm or 6 in long. They can be made from scrap lumber. The students practice using saws, the miter box, and other carpentry tools.

An indoor or outdoor pool can be made using a heavy-duty plastic drop cloth. The walls of the pool can be supported with wood boards. (See the grade one activity 1.7.6 MAKING A LAKE.) The pool should be deep enough so the propellers do not touch bottom.

STUDENT ROLES

Marine engineer
Carpenter

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MATERIALS

hammers
saws
miter boxes
scrap lumber (pieces of 1 in x 2 in boards)
propeller materials (See Activity 3.8.3 WIND PULLS AND PUSHES)
large rubber bands
other materials and tools as requested by the students
Student Page 3.7.3 PROPELLER-DRIVEN BOAT DESIGN

PRODUCTS

Propeller-driven boats
Completed Student Pages

PROCEDURES

1. **Announce the upcoming propeller-driven boat race to the class.**

   Have the students discuss and decide on
   - The dimensions of their boats.
   - The materials that can be used.
   - The tools that can be used.

2. **Have the students design the hull of their boats. Have them submit their designs on Student Page 3.7.3 PROPELLER-DRIVEN BOAT DESIGN to the master boat builder, the teacher, for approval.**

3. **Have the students explore modifications to their air propellers so they can be used in water.**

   Have them
   - Attach their propellers to their boats.
   - Test their propeller-driven boats.

4. **Have the class establish rules for the boat race.**

5. **Have the students build the pool and race their boats.**

6. **Summarize the activity with the class.**

Ask such questions as these:
- What did you do to modify your propeller so it worked in water?
- What did you do to get your boat to go straight when it was driven by a propeller?
- Which of the boats worked best?
- How was this boat different from the rest of the boats?
- How would you modify your own boat design if you were to race again?

EXTENSIONS

- Have the students modify their boats and race again.
- Have the students research different kinds of propeller-driven boats to see how they differ.

ILLUSTRATIONS

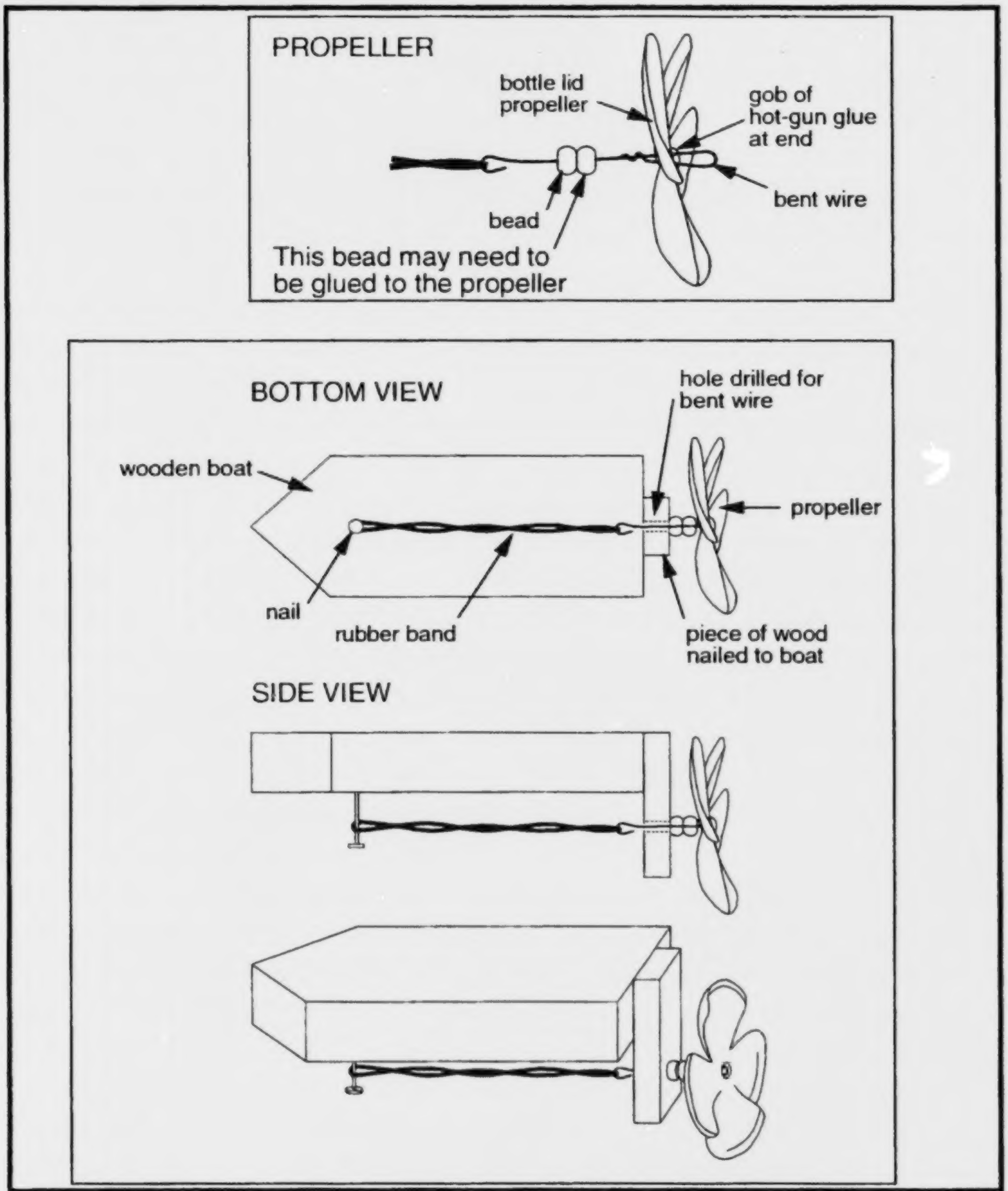
PROPELLER
bottle lid propeller
gob of hot-gun glue at end
bent wire
bead
This bead may need to be glued to the propeller
BOTTOM VIEW
hole drilled for bent wire
wooden boat
propeller
nail
rubber band
piece of wood nailed to boat
SIDE VIEW

Figure 3.7.3 Propeller-Driven Boat

3.7.4 DELIVERY SYSTEMS

OBJECTIVES

The students
- Discuss ways to transport goods.
- Invent and design delivery systems.
- Construct and use delivery systems.

BACKGROUND

This activity is done prior to playing the Supermarket Game. It is introduced when the need arises to transport goods between producers and consumers or users. The students invent their own delivery systems using previously explored ideas such as pulleys and ropes or new ideas such as carts on tracks or pull-lines.

STUDENT ROLES

Inventor
Engineer

MATERIALS

chart paper
markers
jar lids for pulleys
string
rope
clothespins
assorted containers
tools and other materials as requested by the students
Student Page 3.7.4 DELIVERY SYSTEM

PRODUCTS

Class list of delivery systems
Delivery systems
Completed Student Pages

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PROCEDURES

1. **Have the class discuss the need to transport goods from one place to another in the Supermarket Game. Have the students make a class list of ways that goods could be moved from one site to another without having to be carried by hand.**

   Help the students include such ideas as
   - Rope and pulley systems.
   - Carts pulled by lines.
   - Carts on tracks.
   - Windup or motorized trucks or carts.

2. **Have student groups invent and build delivery systems to move goods between the producers and users in the Supermarket Game.**

   Have them
   - Use Student Page 3.7.4 DELIVERY SYSTEM to record their designs.
   - Modify their inventions as necessary.

3. **Have the class discuss and summarize the activity.**

   Ask such questions as these:
   - Which delivery systems worked better?
   - How were they different from those that worked less well?
   - What operating problems had to be considered?
   - How could you further modify your system to work better?

EXTENSION

- Have the students research and report on the delivery systems used by local supermarkets.

DASH

GARDEN MOVER
SP 3.7.1

Name: ______________________

Date: ______________________

DESIGN TEAM:

MATERIALS:

TOOLS:

Draw and label a picture of your design.
Include measurements.

DASH

PROPELLER-DRIVEN MESSAGE CARRIER DESIGN

SP 3.7.2

Name: ______________________

Date: ______________________

DESIGN TEAM:

MATERIALS:

Draw and label a picture of your design.

DASH

PROPELLER-DRIVEN BOAT DESIGN
SP 3.7.3

Name: ______________________

Date: ______________________

DESIGN TEAM:

MATERIALS:

Draw and label a picture of your design for your propeller-driven boat.

DASH

DELIVERY SYSTEM
SP 3.7.4

Name: ______________________

Date: ______________________

DELIVERY SYSTEM DESIGNED TO TRANSPORT ______________________
(ITEMS TO BE CARRIED)

BETWEEN ____________ AND ____________
(LOCATION 1) (LOCATION 2)

DESIGN TEAM:

MATERIALS:

Draw and label a picture of your delivery system.

DASH

GRADE THREE
CLUSTER 8

ENERGY AND COMMUNICATION

3.8.1 Shadow, Light, and Bubbles
3.8.2 Wind and Heat
3.8.3 Wind Pulls and Pushes
3.8.4 Propellers Driving Propellers
3.8.5 Waterwheels
3.8.6 Propellers in Water
3.8.7 Heliograph
3.8.8 Speaking Tube
3.8.9 String Telephone
3.8.10 Energy Definitions

3.8.1 SHADOW, LIGHT, AND BUBBLES

OBJECTIVES

The students
- Invent bubble breeze-finders.
- Observe the effects of light breezes at the interface of sunlit and shadow areas.
- Hypothesize as to why light breezes occur at these interfaces.

BACKGROUND

Introduce this activity in the early morning of a sunny fall day when there is no apparent wind. Mix 1 cup of liquid dishwashing detergent with 10 cups of water. To make longer-lasting bubbles, add 1/4 cup glycerin or light corn syrup. Age the solution overnight. If the solution is not producing good bubbles, add more water, 1/4 cup at a time.

STUDENT ROLES

Inventors
Meteorologists

MATERIALS

straws
styrofoam cups and trays
cardboard tubes
Dawn or Joy dishwashing detergent
glycerin or light corn syrup (optional)
water
measuring cup
large open container such as a kitty litter pan
Student Page 3.8.1 LIGHT BREEZES

PRODUCTS

Bubble breeze-finders
Completed Student Pages

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PROCEDURES

1. **Report to the class that when you came into the building you saw some leaves and paper being blown about near the building.**

   Ask such questions as these:
   - Did anyone else notice this?
   - Where did you see it?
   - Was this really wind?
   - How could there be wind when our wind indicator shows none?
   - How could we check to see if there is some kind of light wind?
   - What might be more sensitive to wind than our wind indicator?
     ✔ Work to the idea of using bubbles.

2. **Have the students invent bubble breeze-finders to make medium-sized bubbles.**

3. **Have the students go outside to observe and record the behavior of medium-sized bubbles. Use Student Page 3.8.1 LIGHT BREEZES.**

   Suggest they observe in such places as
   - Next to a building in the sunlight.
   - Next to a building in shadow.
   - At the interface of the sunlight and shadow.
   - In an open area.

4. **Have the students summarize their observations.**

   Ask such questions as these:
   - Did you find a breeze? If so, where?
   - How did you know it was a breeze?

- In what direction did the bubbles go?

- In what direction was the breeze blowing? How do you know?

- What happened to the bubble when it got above the building? Why do you think this happened?

- Was there any breeze on the sunny side of the building where there was no shadow?
  ✔ Usually there will be none.

- How did the bubbles act in the open area?

- What are the differences between the areas in shadow and the areas in sunlight?
  ✔ Get at the differences in light and temperature.

- What might cause the breeze?
  ✔ Accept all answers, but work to include differences in light and differences in temperature.

- If your hypothesis about the cause of wind is true, where else might you find light breezes?

5. **Have student groups predict where they might find more light breezes. Have them use their bubble breeze-finders to test their predicted locations.**

6. **Summarize the light breeze search with the class.**

   Ask such questions as these:
   - Did anyone find other light breezes?
   - Where did you find them?
   - Were they where you predicted them to be?
   - Does this change your hypothesis to explain the formation of wind and breezes?

EXTENSIONS

Have the students
- Map the school campus predicting light breezes for a windless day under cloud cover in the middle of winter.

- Test their predictions and report their results.
- Revise their hypotheses to explain the formation of wind and breezes to include any new findings.

3.8.2 WIND AND HEAT

OBJECTIVES

The students
- Produce winds in as many different ways as they can.
- Analyze their different methods for similarities and differences.
- Use their exploration to discuss the formation of sunlight-shadow breezes.

BACKGROUND

This activity follows 3.8.1 SHADOW, LIGHT AND BUBBLES. The students continue their investigation of the different ways that wind is formed. In particular they explore the relationship between wind formation and temperature differences. The students use their new findings to revise their explanation of sunlight-shadow breezes begun in Activity 3.8.1.

STUDENT ROLES

Inventor
Meteorologist

MATERIALS

shielded electric light bulb
syringes
rubber band-driven propeller
hot water
cold water
cups
plastic bottles with narrow openings
other materials as requested
thread
small sticks
Wonder and Discover Book
Student Page 3.8.2 WIND MAKERS

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PRODUCTS

Wind makers
Completed Student Pages

PROCEDURES

1. **Challenge student groups to use the items in the Inventor's Box and other things in the room to invent different ways to make breezes.**

   Have the groups

   - Use a thread tied to a small stick to act as a wind indicator.
   - Record their inventions on SP 3.8.2 WIND MAKERS.

2. **Have each group demonstrate one way that they produced a light breeze. To avoid repetition have each method demonstrated only once but give recognition to each group that had the same idea as one given previously.**

   Ask such questions as these:
   - Does everyone agree that this is a way to produce a measurable breeze?
   - What seems to cause the breeze?
   - How is this way of making a breeze similar to others we have observed? How is it different?
   - Where else have you seen winds or breezes produced like this?
     ✔ Try to help the students connect each example with some natural or technological production of wind or breezes.

   Some specific questions for particular items might be
   - What kind of breeze were you able to get from the syringe?
   - Did anyone get two kinds of breezes from the syringe? What were they?
     ✔ Get at drawing in and a pushing out.
   - What kind of breezes did you get from your mouth or nose?

- Did anyone get two kinds of breezes? What were they?
- How are the syringe and the mouth similar?
  ✔ If the students have studied the lung in Activity 3.6.5 LUNG MODEL they should observe that the lung operates much like a syringe. If not, record the question in the Wonder and Discover Book.
- What kind of breeze did you get from the light bulb? How did you know you had a breeze?
- What direction does hot air seem to move?
  ✔ Work toward evidence for moving upward.
- What direction does cold air seem to move?
  ✔ Work toward evidence for moving downward.
- Which of the ways you have produced breezes helps explain the breezes found using bubbles in the sunlight-shadow region of the building?
  ✔ Review the movement of the bubbles on SP 3.8.1 LIGHT BREEZES.

3. **Have students go outside and observe the movement of bubbles in shadow and sunlit areas to verify or invalidate their hypotheses. Have them revise their hypotheses as necessary.**

EXTENSION

- Have the students make a display of ways that wind can be produced including their wind-making devices.

3.8.3 WIND PULLS AND PUSHES

OBJECTIVES

The students
- Investigate the wind stream from a propeller.
- Identify the pushing and pulling actions of the propeller's wind stream.
- Observe that the wind can be directed to push objects in any direction.

BACKGROUND

This activity introduces the students to the use of propellers to produce wind. A propeller-driven toy or a fan is used in the introductory procedure. Student pairs are then challenged to make their own propellers. If they encounter difficulties, encourage them to take a closer look at the fan or toy propeller. Use questions as necessary to help them observe the shape and angle of the propeller blades. Encourage the more successful students to help others. Allow sufficient time so that all student pairs produce a working propeller. As the students complete their construction, have them go on to the wind stream investigations. They will need to use the wind indicators they made in Activity 3.8.2 WIND AND HEAT or small bubbles (See Activity 3.8.1 SHADOW, LIGHT, AND BUBBLES.) to determine the path of the wind stream produced by their propellers.

STUDENT ROLES

Physicist
Inventor

MATERIALS

propeller-driven toy or fan
glue
string
thread
wood for propellers (tongue depressors)
foil cake or pie pans (recycled)

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stiff plastic (recycled detergent bottles)
exposed low-wattage light bulb for shaping plastic
large paper clips
chopsticks or other sticks 25–30 cm (10–12 in) long
long rubber bands
small beads
other materials and tools as requested by the students.
wind indicators (See Activity 3.8.2 WIND AND HEAT)
bubble liquid (See Activity 3.8.1 SHADOW, LIGHT, AND BUBBLES)
small bubble makers (straws)
Student Page 3.8.3 PROPELLERS AND WIND

PRODUCTS

Propellers
Completed Student Pages

PROCEDURES

1. **Introduce the idea of using a propeller to produce wind using a propeller-driven toy or a fan.**

   Ask such questions as these:
   - What seems to make this toy move?
   - How is the toy moving?
   - What is the propeller moving?
     ✔ Air.
   - What is it about the propeller that seems to make the air move?
   - What seems to make the propeller move?

2. **Have the students work in pairs to invent propellers using the materials in the Inventor's Box. Have them demonstrate their working propellers.**

3. **Challenge the students to explore the following list of problems. They will need to use their wind indicators from 3.8.2 WIND AND HEAT or small bubbles. Have them record their findings on SP 3.8.3 PROPELLERS AND WIND.**

Suggest such investigations as

- Problem 1. When the propeller is moving, what is the path of the wind around it?
- Problem 2. Are there parts of the wind path where air seems to be pulled? If so, where?
- Problem 3. Are there parts of the wind path where the air seems to be pushed? If so, where?
- Problem 4. Can you direct the air as it leaves the propeller? If so, how? Where can you direct it?
- Problem 5. Can you direct the path that the air will follow as it goes to the propeller? If so, how? Where can you direct it?
- Problem 6. What other questions do you have about wind and propellers?

4. **Summarize the results of the investigations with the class.**

Ask such questions as these:

- Problem 1. What did the path of the air moving around the propeller look like? What direction was the air going in different parts of the path? What was your evidence?
  ✔ Work to a class agreement.
- Problem 2. Did anyone find parts of the path where air seem to be pulled? If so, where?
  ✔ Work to a class agreement.
- Problem 3. Did anyone find parts of the path where the air seems to be pushed? If so, where?
  ✔ Work to a class agreement.
- Problem 4. Was anyone able to direct the air leaving the propeller? If so, how? Where were you able to direct it?
- Problem 5. Was anyone able to direct the path that the air took as it went to the propeller? If so, how? Where did you direct it?
- Problem 6. What questions of your own did you investigate? What were your findings?

EXTENSIONS

- Have the students make smaller propellers that can be placed in water and explore the same problems.
- Have the students find and create a display of other manufactured and natural propellers.

3.8.4 PROPELLERS DRIVING PROPELLERS

OBJECTIVES

The students
- Make windmills.
- Observe how wind produced by one device can drive another.
- Observe the effect of the angle of the blade on the direction of the wind produced.

BACKGROUND

This activity continues the study of wind. It follows Activity 3.8.3 WIND PULLS AND PUSHES. The students investigate how wind can drive a machine. An electric fan is used as a wind source after the students complete the first two problems.

STUDENT ROLES

Aeronautical engineer
Wind researcher

MATERIALS

propellers from Activity 3.8.3 WIND PULLS AND PUSHES
wood for a windmill blade (tongue depressor)
glue
electric fan
wind detectors from Activity 3.8.2 WIND AND HEAT
jar lids
heavy foil pie or cake tins
wood
heavy scissors
nails
washers
beads
nuts and bolts
hammers
drill
rubber bands

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other materials or tools as requested by the students
Student Page 3.8.4 WINDMILLS

PRODUCTS

Windmills
Completed Student Pages

PROCEDURES

1. **Have student groups invent and construct windmills. Some research may be necessary or a model can be provided as an example. See Figure 3.8.4(1) Windmill Blade.**

2. **Have the students explore the following problems and record their findings on SP 3.8.4 WINDMILLS.**

   - Problem 1. Direct the wind from the propeller against the windmill.
     - Describe what happens to the windmill.
     - Describe the path of the wind from the propeller through and beyond the windmill.
   - Problem 2. Make the propeller turn in the opposite direction.
     - What happens to the direction of the wind from the propeller?
     - What happens to the windmill?
     - Describe the path of the wind from the propeller through and beyond the windmill.
   - Problem 3. Use pulleys to make a wind-driven machine that will lift a small box off the floor.
     ✔ See Figure 3.8.4(2) Windmill.
     Use a fan as a wind source.
     - Draw and label a diagram of your machine.
     - Describe how it works.

- Problem 4. Investigate your own questions and ideas about windmills.
    - Record your questions and ideas.
    - Report your findings.

3. Summarize the activity with the class.

Ask such questions as these:

- What happens to the path of the air as the propeller wind drives the windmill?
  ✔ Have the students share their drawings.
- Were there places in the wind path where the air seemed to be pulling? If so, where were these places?
- Were there places in the wind path where the air seemed to be pushing? If so, where were these places?
- What happened to the direction of the wind when the propeller was turned in the opposite direction?
- Was anyone able to make a pulley system that used wind to raise a box off the floor?
  ✔ Have the students demonstrate their machines.
- What questions of your own did you investigate? What did you find out?

EXTENSION

- Have the students research windmills to see how they have been used throughout history.

ILLUSTRATIONS

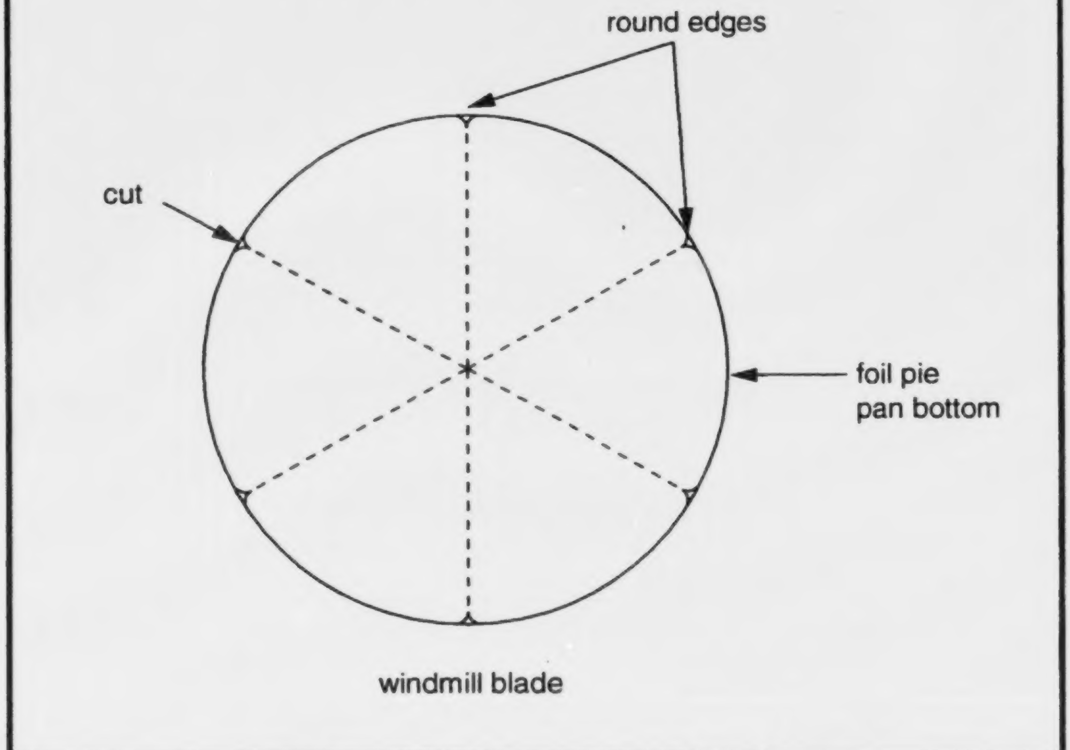
round edges
cut
foil pie
pan bottom
windmill blade

Figure 3.8.4(1) Windmill Blade

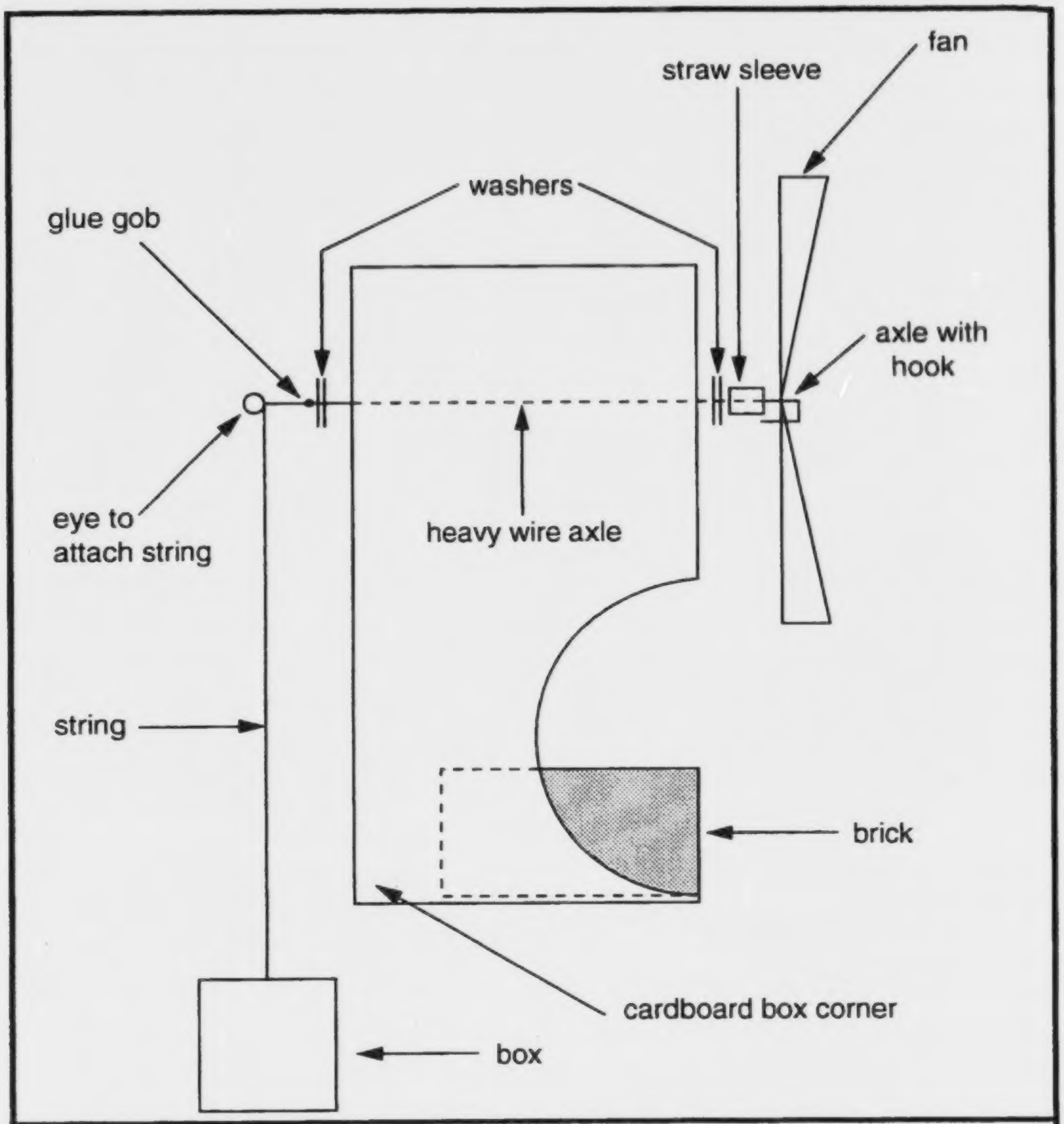
fan
straw sleeve
washers
glue gob
axle with hook
eye to attach string
heavy wire axle
string
brick
cardboard box corner
box

Figure 3.8.4(2) Windmill-driven Pulley

3.8.5 WATER WHEELS

OBJECTIVES

The students
- Construct water wheels.
- Invent a water wheel-driven clock.

BACKGROUND

Water is easier to control than wind. In this activity the students use the experiences they have had with windmills to invent water wheels. If students encounter difficulty with their inventions, provide them with reference materials, pictures, or a model. (See Figure 3.8.5 WATER WHEELS.) When the students have a working water wheel, they are challenged to modify it to function as a clock. Be sure to allow sufficient time for the invention process.

STUDENT ROLES

Chronometer maker
Inventor

MATERIALS

saws
nails
hammers
other materials as requested by the students
tongue depressors
ice cream sticks
lightweight sheet metal
jar lids
tin cans
waterproof glue
tin snips
plastic bottles
Student Page 3.8.5 WATER WHEEL CLOCK

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PRODUCTS

Water wheels
Water wheel clocks
Completed Student Pages

PROCEDURES

1. **Have student groups invent water wheels. Have them share their inventions with the class.**

2. **Have the students experiment with their water wheels so that they can adjust them to make one turn every 20–30 seconds.**

   Ask such questions as these:
   - Was anyone able to adjust their water wheel so that it would turn about once every 20–30 seconds?
   - Can you demonstrate how you did it?

3. **Challenge the students to explore and modify their water wheels to invent a clock that will run for an hour and record at 5-minute intervals. Have them use SP 3.8.5 WATER WHEEL CLOCK to record their designs.**

   Ask such questions as these:
   - How could you get a water wheel to turn something slower?
   - How could you get a water wheel to turn something faster?
   - Do all clocks have hands?
   - How else could you show change in time.
     ✔ Work toward the idea of a linear scale.
   - How could you get enough water to run a clock for an hour?

4. **Have student groups demonstrate their inventions.**

EXTENSION

- Have the students research and report on various kinds of water clocks.
- Have the students invent water wheel boats.

ILLUSTRATIONS

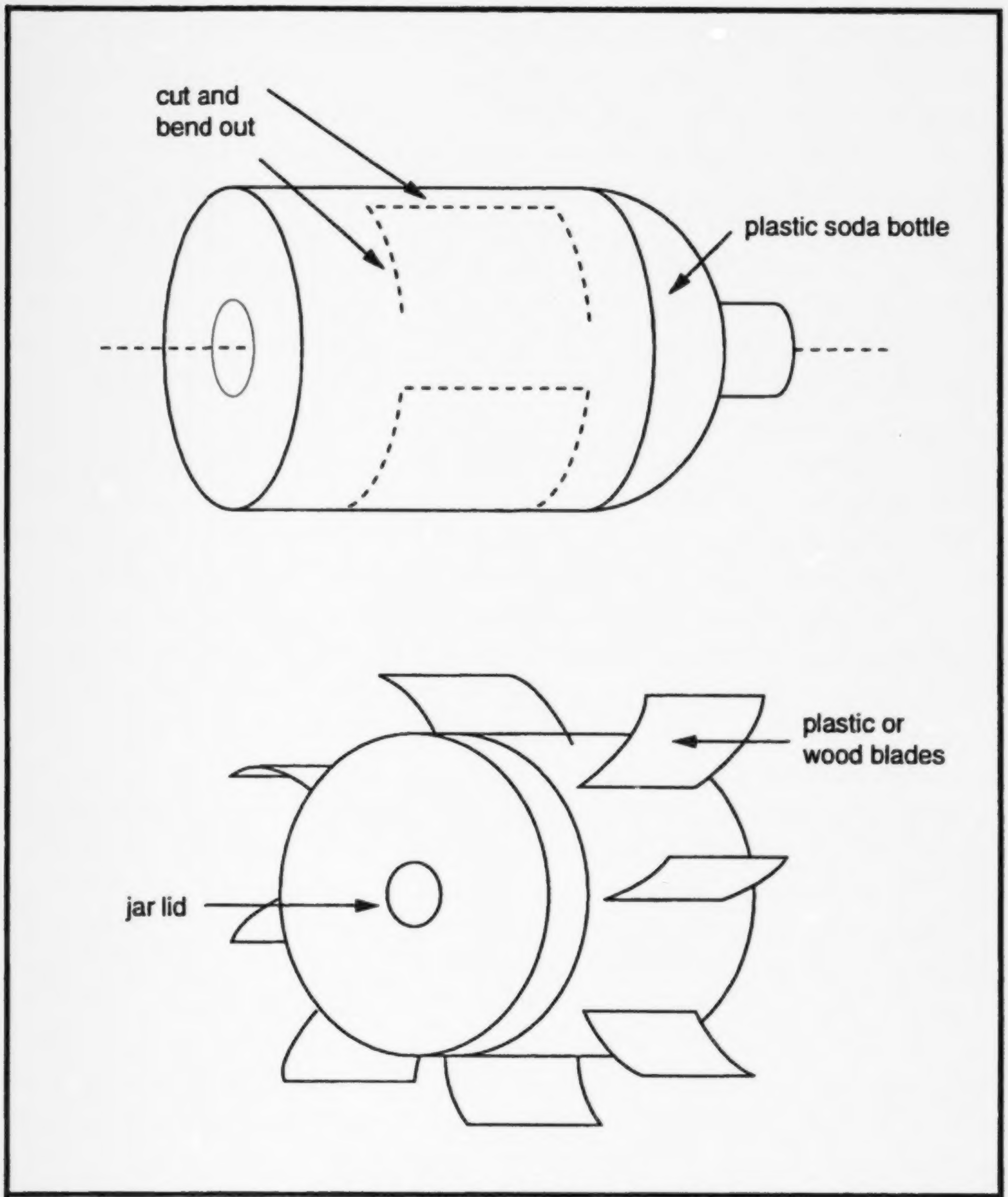
cut and
bend out
plastic soda bottle
plastic or
wood blades
jar lid

Figure 3.8.5 Water Wheels

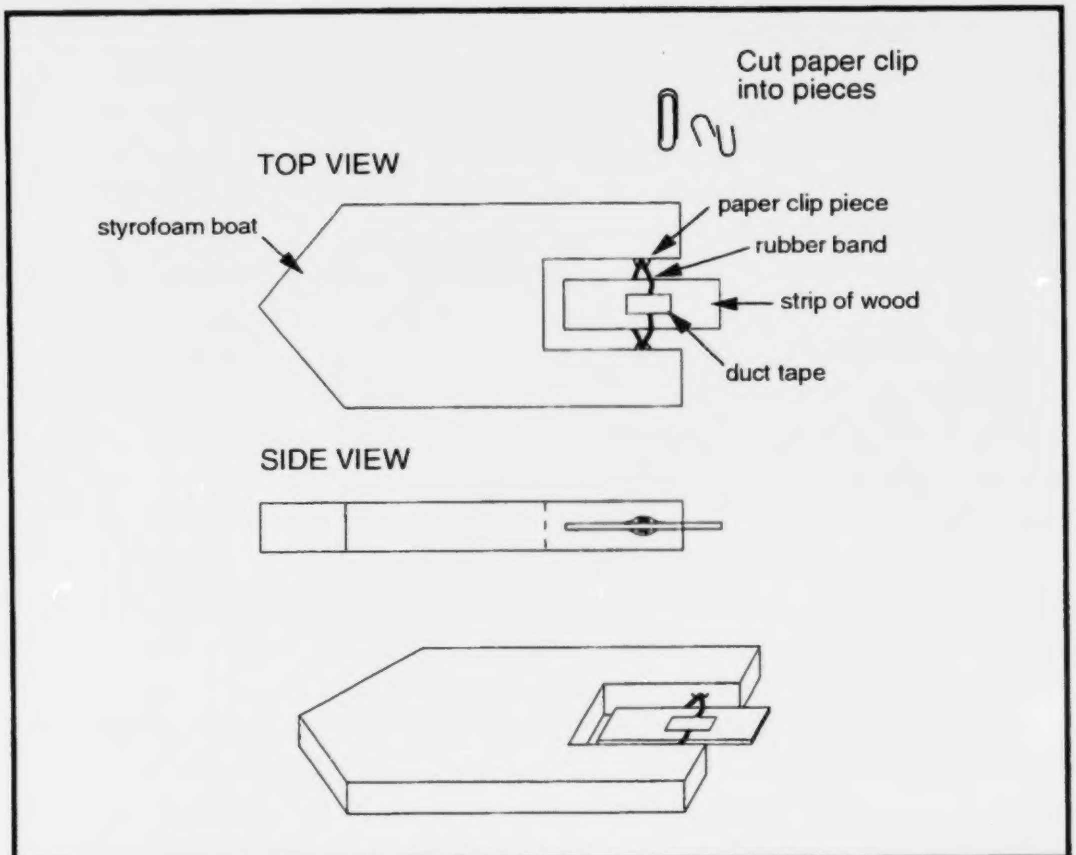
Cut paper clip into pieces
TOP VIEW
styrofoam boat
paper clip piece
rubber band
strip of wood
duct tape
SIDE VIEW

Figure 3.8.5 Water Wheel (extension)

3.8.6 PROPELLERS IN WATER

OBJECTIVES

The students
- Observe the path of water as it enters and leaves a propeller.
- Compare the paths of water and air as each moves through propellers.

BACKGROUND

This activity is done along with Activity 3.7.3 PROPELLER-DRIVEN BOATS so that a large container of water is available. The students use their water propeller to observe how water flows through and around it. Then they compare their findings with the path of air through a propeller that they investigated in Activity 3.8.3 WIND PULLS AND PUSHES.

STUDENT ROLES

Marine engineer
Physicist

MATERIALS

propeller-driven boat from Activity 3.8.3 WIND PULLS AND PUSHES
large water container
food coloring or ink
small pieces of Styrofoam
Student Pages 3.8.3 PROPELLERS AND WIND
3.8.6 PROPELLERS IN WATER

PRODUCT

Completed Student Pages

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PROCEDURES

1. **Have the class review the results of Activity 3.8.3 WIND PULLS AND PUSHES where the students traced the path of air through a propeller. Then discuss ways to trace the path of water through a propeller.**

   Ask such questions as these:
   - How did you trace the path of air through a propeller?
   - How could you trace the path of water through a propeller?
     ✔ Work to the idea of putting something in the water and watching it go through a propeller.
   - What could you put into the water?
     ✔ Work to the idea that ink, food coloring, or things that float could be used.

2. **Have the students use things from the Inventor's Box to follow the path of water as it goes through the propeller. Have them use Student Page 3.8.6 PROPELLERS IN WATER to record their findings. (See Figure 3.8.6.)**

3. **Summarize the activity with the class.**

   Ask such questions as these:
   - What did the path of the water going through the propeller look like?
   - Were there places where the water stream from the propeller seemed to be pulling on the water around it? Where?
   - Were there places where the water stream from the propeller seemed to be pushing on the water around it? Where?
   - How does the path of the water path compare with the path of air going through a propeller?

EXTENSION

- Set up a Water Movement Center and have the students observe and record the paths of other objects moving through water.

ILLUSTRATION

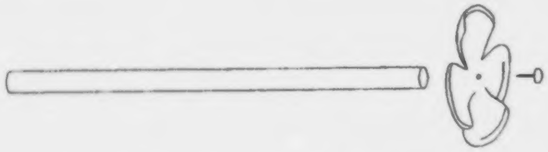

Figure 3.8.6 Propellers

3.8.7 HELIOGRAPH

OBJECTIVES

The students
- Invent a system or code to send information using their heliographs.
- Invent a device to send information using light.
- Explore some of the properties of light.

BACKGROUND

In this activity the students invent systems to transmit information using light. This calls for the invention of a code or the use of an existing code such as the Morse code. The device will be used to send information between the groups in the Supermarket Game. The heliograph can be introduced during the building of the supermarket (See Activity 3.10.11 SUPERMARKET CONSTRUCTION) or once the Supermarket Game has begun if the need arises.

STUDENT ROLES

Cryptographer
Inventor

MATERIALS

foil
cardboard
mirrors
flashlights
other materials and tools as requested by the students
Student Page 3.8.7 HELIOGRAPH CODE

PRODUCTS

Heliographs
Code system
Completed Student Pages

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PROCEDURES

1. **Introduce the problem of sending information using light.**

   Ask such questions as these:
   - How could you use light to signal someone?
     ✔ Work to the ideas of using mirrors or flashlights.

   - How could you use light to send information?
     ✔ Work to the need for a code.

2. **Have student groups invent codes and practice using them. Use SP 3.8.7 HELIOGRAPH CODE.**

3. **Have the students invent heliographs to send information between groups in the Supermarket Game.**

EXTENSION

- Have the students research and report on the use of the heliograph.

DASH

3.8.8 SPEAKING TUBE

OBJECTIVES

The students
- Invent and use speaking tube systems.
- Investigate some of the properties of sound.

BACKGROUND

This activity provides another means of communication between student groups in the Supermarket Game. Encourage different groups to use different systems. The speaking tube is the predecessor to the telephone. It was used for short-distance communication such as between decks on a ship.

STUDENT ROLES

Inventor
Sound engineer

MATERIALS

cardboard tubes
tape
hose or other large-diameter tubing
funnels
other materials and tools as requested by the students
Student Page 3.8.8 SPEAKING TUBE

PRODUCTS

Speaking tube systems
Completed Student Pages

PROCEDURES

1. **Discuss the need for different ways to communicate between groups in the Supermarket Game.**

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Ask such questions as these:

- Has anyone ever made a speaking tube?
  ✔ Have the students describe their prior inventions. If they have not had this experience, have a model available to demonstrate.

- Does anyone know where a speaking tube was commonly used?
  ✔ It was used on ships to communicate between the engine room and the bridge.

2. **Have student groups design, construct, and test speaking tubes.**

3. **Have the students investigate one or more questions or problems about speaking tubes. Have them use SP 3.8.8 SPEAKING TUBE to record their findings.**

   Pose such questions and problems as

   - Will the system work when the tube is coiled? What happens to the quality of the sound as the tube is straightened?
   - How far can you transmit a loud whisper through the speaking tube?
   - Can you modify your tube system to transmit sound further?
   - What happens when two tubes lay across each other during a conversation?
   - Can you modify your tube so that you can transmit around a corner? How?
   - How does a wet tube work compared to a dry tube?
   - Can you feel anything on the tube when you are speaking through it?
   - How does the speaking tube seem to work?
   - What other questions do you have about speaking tubes?

4. **Have the students report their results to the questions in Procedure 3.**

5. **Have the students use their speaking tubes as one of the communication systems in the Supermarket Game.**

EXTENSION

- Have the students report on other kinds of things that work the same way as speaking tubes.

ILLUSTRATION

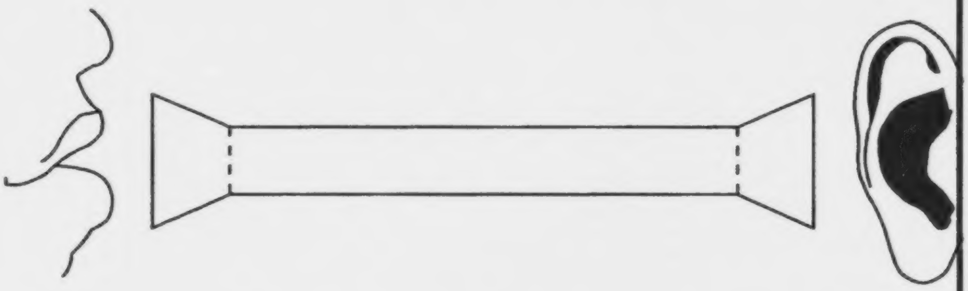

Figure 3.8.8 Speaking Tube

3.8.9 STRING TELEPHONE

OBJECTIVES

The students
- Invent and use string telephones.
- Investigate some of the properties of sound.

BACKGROUND

This is the third activity in the series of student-invented communication devices for use in the Supermarket Game. The students design and construct string telephones. They continue their investigation of some of the properties of sound.

STUDENT ROLES

Inventor
Sound engineer

MATERIALS

nylon string
cups
cans
other materials and tools as requested by the students
Student Page 3.8.9 STRING TELEPHONE

PRODUCTS

String telephones
Completed Student Pages

PROCEDURES

1. **Have the class discuss the need for ways to communicate between the groups in the Supermarket Game.**

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Ask such questions as these:

- How do stores get their orders to food producers?
  ✔ Include such things as telephones, fax, mail, and salesmen.

- How are people who use a telephone connected to each other?
  ✔ Work to include such ideas as the need for phone lines and things to use for listening and speaking.

- Has anyone ever made a string telephone?
  ✔ Have the students describe their previous inventions. If they have not had any previous experiences, have a model available to demonstrate.

- How are standard telephones and string telephones similar? How are they different?
  ✔ Work toward the idea that the standard telephone is an electrical system with copper wires and electricity while the string telephone uses string and sound.

2. **Have student groups design, construct, and test string telephones.**

3. **Have the students investigate one or more questions or problems about string telephones. Have them use SP 3.8.9 STRING TELEPHONE to record their findings.**

Pose such questions or problems as

- Will the string telephone system work when the string is loose? What happens to the quality of the sound as the string is tightened?

- How far can you transmit a loud whisper through the string telephone? Can you modify your phone system to transmit further?

- What happens when two lines lay across each other during a conversation?

- Can you modify your line so that you can transmit around a corner? How?

- How does a wet string work compared to a dry string?

- Can you feel anything when the string telephone is working?

- How do you think a string telephone works?

- What other questions do you have about string telephones?

4. **Have the students report their findings to the questions and problems in Procedure 3.**

5. **Have the students use their string telephones as one of the communication systems in the Supermarket Game.**

EXTENSION

- Have the students research and report on the kinds of things that work the same way as a string telephone.

ILLUSTRATIONS

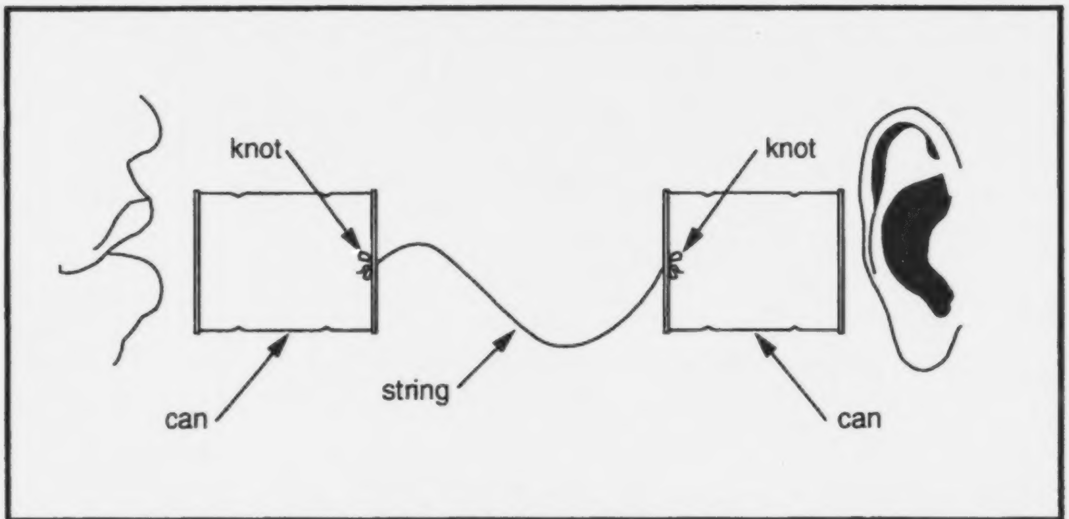


Figure 3.8.9 String Telephone

3.8.10 ENERGY DEFINITIONS

OBJECTIVES

The students
- Discover and demonstrate ways to transform energy.
- Revise their working definition of energy

BACKGROUND

The students begin this activity by reviewing their working definition of **energy**. Their earlier definition should include the idea that energy is something that goes, grows, or glows. If the students are new to DASH, have them make a concept map about energy and then create a working definition using their map. This activity also introduces the students to the concept of energy transformation. They try to find and demonstrate one form of energy producing another form of energy.

STUDENT ROLES

Physicist
Lexicographer

MATERIALS

chart paper
markers
Working Dictionary
Student Page 3.8.10 ENERGY TRANSFORMATIONS

PRODUCTS

Working definition of energy
Completed Student Pages

BEST COPY AVAILABLE

PROCEDURES

1. **Have the class review their working definition for energy.**

   Ask such questions as these:
   - What are some examples of energy in things that **go** or move?
     ✔ Work toward such ideas as walking or running animals, moving vehicles, and falling rocks.

   - What are some examples of energy in things that **glow** or have warmth?
     ✔ Work toward such ideas as the sun, an electric light bulb, fire, and a human body.

   - What are some examples of energy in things that **grow** or increase in size?
     ✔ Work toward such ideas as a growing puddle of water in the rain and growing animals and plants.

2. **Discuss the idea of energy transformation. Have the students find and demonstrate or describe examples of one form of energy producing another form of energy. Have them use SP 3.8.10 ENERGY TRANSFORMATIONS to record their ideas.**

   Help them include such ideas as
   - Movement that produces growth or an increase in size.
     ✔ Some examples are moving water through a hose to fill a jar and shoveling sand to build a sand pile.

   - Movement that produces a glow or warmth.
     ✔ Some examples are rubbing hands together to produce heat, turning a drill in a piece of wood to produce heat, and striking a match.

   - Growth that produces a glow or warmth.
     ✔ One example is the decomposition in the compost which produces heat.

   - Growth that produces movement.
     ✔ One example is growing seeds and plants that push other things out of their way.

   - Warmth or a glow that produces growth.
     ✔ Some examples are sunlight producing growth in plants and heat causing things to expand.

- Warmth or a glow that produces movement.
  ✓ One example is sunlight producing movement in air or wind.

3. **Have the students revise their working definition of energy and record it in the Working Dictonary.**

4. **Have the students review and add to their previous ideas about energy in their Connections Book.**

   Ask such questions as these:
   - Who needs to know about energy and energy transformations?
   - How are energy transformations used in industry? At home?

EXTENSION

- Have the students collect and organize their examples of energy transformations into a class book.

DASH

LIGHT BREEZES
SP 3.8.1

Name: ____________________

Date: ____________________

GROUP:	
LOCATION	BUBBLE OBSERVATIONS
Next to a building in the sunlight	
Next to a building in a shadow	
Where the sunlight and shadow interface	
In an open area	

SP 3.8.2

DASH

WIND MAKERS
SP 3.8.2

Name: ______________________

Date: ______________________

INVENTION TEAM:

Draw and label each of the wind makers invented by your group.
Describe how each works.

DASH

PROPELLERS AND WIND
SP 3.8.3

Name: ______________________

Date: ______________________

QUESTIONS	DRAW OR DESCRIBE YOUR RESULTS.
1. When the propeller is moving, what is the path of the wind around it?	
2. Are there parts of the wind path where air seems to be pulled? If so, where?	
3. Are there parts of the wind path where the air seems to be pushed? If so, where?	
4. Can you direct the air as it leaves the propeller? If so, how? Where can you direct it?	
5. Can you direct the path that the air will follow as it goes to the propeller? If so, how? Where can you direct it?	

DASH

WINDMILLS
SP 3.8.4 Page 1

Name: ______________________

Date: ______________________

PROBLEM	FINDINGS (Describe or draw and label.)	
1. Direct the wind from the propeller against the windmill.	What happened to the windmill.	The path of the wind through and beyond the windmill.
2. Make the propeller turn in the opposite direction.	What happens to the direction of the wind from the propeller.	What happens to the windmill.
	The path of the wind from the propeller through and beyond the windmill.	

DASH

WINDMILLS
SP 3.8.4 Page 2

Name: ____________________

Date: ____________________

PROBLEM	FINDINGS (Describe or draw and label.)	
3. Use pulleys to make a wind-driven machine that will lift a small box off the floor.	Draw and label a picture of your machine.	How does it work?

DASH

WATER WHEEL CLOCK
SP 3.8.5

Name: ______________________

Date: ______________________

Design Team:

Draw and label a picture of the design for your water wheel clock.
Describe how it works.

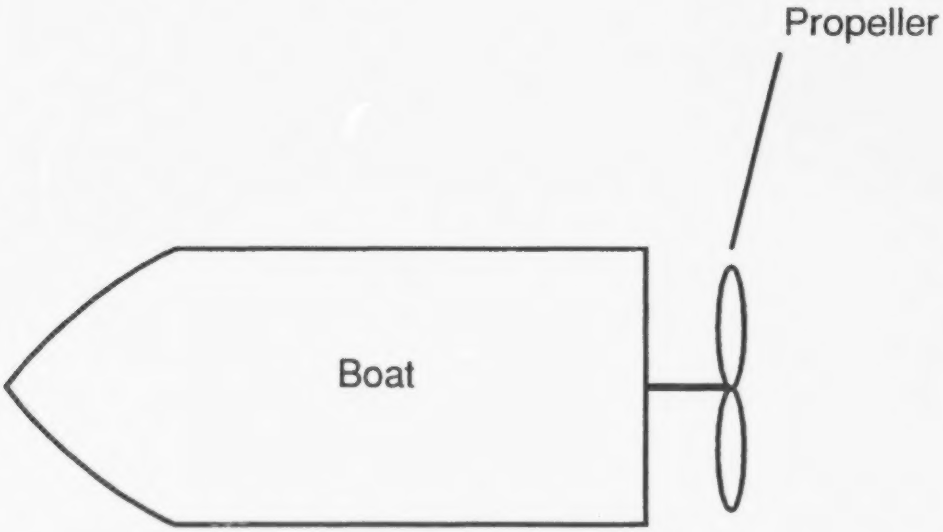
DASH

PROPELLERS IN WATER SP 3.8.6

Name: ____________________

Date: ____________________

Use arrows to show how the food coloring in the water moved through and around the propeller.



SP 3.8.7

DASH

HELIOGRAPH CODE SP 3.8.7

Name: ____________________

Date: ____________________

LETTER OR WORD	CODE	LETTER OR WORD	CODE

DASH

SPEAKING TUBE
SP 3.8.8

Name: ____________________

Date: ____________________

PROBLEM	FINDINGS

DASH

STRING TELEPHONE
SP 3.8.9

Name: ______________________

Date: ______________________

PROBLEM	FINDINGS

DASH

ENERGY TRANSFORMATIONS SP 3.8.10

Name: ______________________

Date: ______________________

KIND OF ENERGY TRANSFORMATION:

______________________ PRODUCES ______________________

Describe or draw and label your example of an energy transformation.

DASH

GRADE THREE
CLUSTER 9

CONSERVATION, RECYCLING, AND DECOMPOSITION

3.9.1 Making Compost
3.9.2 Watching Compost
3.9.3 Animals in Compost
3.9.4 Using Compost
3.9.5 Fall Unearthing and Burial
3.9.6 Spring Unearthing and Burial

3.9.1 MAKING COMPOST

OBJECTIVES

The students
- Recycle garbage by composting.
- Observe the changes that occur during the decomposition of the compost materials.
- Use the compost for their garden project.

BACKGROUND

In DASH students at each grade level collect and recycle some common material. Different schools have different opportunities for recycling projects. The most commonly recycled materials are paper, aluminum, iron, plastic, glass, and garbage. Garbage is the suggested recycling material in grade three.

Garbage is recycled by composting. Composting is used for several reasons. The compost provides soil nutrients for the garden project in Cluster 4, Plants. Composting builds on the decomposition experiments begun in kindergarten. It is used worldwide as a technique to recycle biological wastes. Composting is an easy process for students to carry out.

There are two basic methods of composting, aerobic and anaerobic. Air is circulated through the garbage in the aerobic composting process. In anaerobic composting the air circulation is cut off.

DASH students will probably have already observed anaerobic decomposition when they sealed garbage in plastic bags in kindergarten to watch it decompose. A common technique for composting without air is to bury the garbage. Buried compost should be turned or spaded up and reburied about two months into the decomposition process. Decomposition will ordinarily take three to four months. The compost can then be left in the ground until needed.

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A hole .5 m deep, .5 m wide, and 1 m long (20 in x 20 in x 40 in) will hold enough compost to be used on a garden measuring 3.5 m by 3.5 m (12 ft x 12 ft).

A second method for making anaerobic compost is to seal the materials in a large (30-gal or larger), heavy-duty plastic bag and leave it for 3–4 months. The compost is ready to use if there is no odor when the bag is opened.

Aerobic composting can be done in 30-gallon or larger plastic or metal containers. The containers should have .5- to 1-in holes drilled or punched in them at 6-inch intervals. A tube made of .5- or .75-in mesh hardware cloth can also be used. The tube should be 1 m high and have a .5-m diameter.

The contents of the container should be turned every other day for two weeks. The material should be taken out of the container, moistened with water, exposed to the air, and then returned to the container. If the temperature of the compost does not reach 45°C within 3 days, there probably isn't enough water or green material. Mix in more fresh green plant materials and water thoroughly. Aerobic composting should be ready to use in about 3 weeks. Once decomposition is completed, the compost can be left in the container or stored in bags until it is needed. Two 30-gallon cans produce enough compost to be used on a garden measuring 3.5 m by 3.5 m (12 ft x 12 ft).

DASH students have observed the process of decomposition for several years and know that small pieces of organic material will decompose in a relatively short time. Large-diameter tree limbs, pieces of wood, and cardboard take much longer. A good compost can be made using a combination of grass cuttings, leaves, shredded paper, meat and vegetable lunch waste, and manure which may be the waste from the classroom pets. A balanced compost is made of a mix that is 3/4 grass and leaves and 1/4 manure and/or lunch waste.

Waste can be put into the anaerobic pit or aerobic container as it is collected. In the pit a light layer of soil can be used to cover each addition. A lid or plastic sheet can be kept on the aerobic compost container. A cultivating fork can be used to mix the already-collected material with the new material. Plant materials produce less odor than animal waste.

Both the aerobic and anaerobic processes require lots of water. The compost should be thoroughly wet down every two to three days when there is no rain. If the decomposition in the aerobic process does not progress as expected, the addition of more green material will get it going.

Each time that the compost is turned, have the students observe and record its physical characteristics, odor, temperature, and texture. Have them observe samples of the compost with hand lenses. Any organisms living in the compost should be recorded on Student Page 3.9.1 COMPOST OBSERVATIONS along with other findings.

STUDENT ROLES

Gardener
Soil scientist

MATERIALS

hand lenses
thermometer
plot of ground 1 m x .5 m to bury anaerobic compost or large heavy-duty plastic bags
two 30–55-gal plastic or metal containers for aerobic composting
drill with a 1-inch or 1/2-inch bit for plastic containers
pick to make holes in metal containers
shovels
cultivating fork
water
compost materials
hardware cloth, 1/2- to 3/4-in mesh for tube 1 m high with .5-m diameter, optional
Student Page 3.9.1 COMPOST OBSERVATIONS

PRODUCTS

Garden compost
Completed Student Pages

PROCEDURES

1. Have the class plan to make the compost.

Help the students include such things as

- Getting permission to dig at a site if a compost pit is used.

- Contacting other classes for manure (pet feces).
- Contacting the school maintenance crew for grass cuttings, trimmings, and leaves.
- Finding ways to collect food waste.
- Collecting tools and containers.
- Setting up a responsibility chart for watering and turning the compost.
- Planning for data collection.

2. Have the students set up the compost pit or container system.

Have them
- Follow appropriate sanitation and safety procedures.
- Dig the pit or prepare the containers.
- Collect the materials to be composted.
- Turn and water the compost.
- Record their observations of the compost on Student Page 3.9.1 COMPOST OBSERVATIONS.

EXTENSIONS

Have the students
- Graph the temperature changes of the compost.
- Investigate and report on other ways garbage is recycled in different parts of the world.

SUGGESTED REFERENCE

1987 "Composting"
University of Hawaii, CRDG: Honolulu.

3.9.2 WATCHING COMPOST

OBJECTIVES

The students
- Observe the compost process in a miniature system.
- Simulate the conditions of the compost pile.

BACKGROUND

This activity should be done at the same time as Activity 3.9.1 MAKING COMPOST. Students watch the processes going on in their compost pile in a transparent plastic bottle. See Figure 3.9.2.

STUDENT ROLE

Agronomist

MATERIALS

two-liter, clear plastic bottles
wire
trays
can for water
compost pile
hand trowel
Student Page 3.9.2 COMPOST IN A BOTTLE

PRODUCTS

Composting observation bottle
Completed Student Pages

BEST COPY AVAILABLE

PROCEDURES

1. **When the students plan for their composting activity, introduce the idea of a Composting Observation Bottle.**

   Ask such questions as these:
   - Since the compost is buried (or in a container), how can we watch what is happening?
   - How could you use a plastic bottle?

2. **Have student groups invent Composting Observation Bottles and holders.**

3. **Have the groups fill their bottles with the same ingredients that they put in the pile.**

   Ask such questions as these:
   - How can we be sure the compost is being watered when the pile is watered?
   - How can we be sure that the watered compost does not drip?
   - How can we be sure that the compost is turned over when the pile is turned over?
     ✔ The materials can be dumped from the bottle and mixed or the old sample can be left in the bottle to observe while a new sample is taken from the pile.
   - How can we measure the acidic and basic condition of the compost in the bottle?

4. **Have the students observe the simulation and record changes several times a week on Student Page 3.9.2 COMPOST IN A BOTTLE.**

5. **Summarize the activity with the class.**

   Ask such questions as these:
   - How does the material in the bottle compare with the compost in the pile?
   - Did any animals appear in the compost bottle? If so, what happened to them?
   - Was there a change in color of the simulated compost? If so, what seemed to cause it?

EXTENSION

- Continue to observe the Compost Observation Bottles after the compost pile is harvested.

ILLUSTRATION

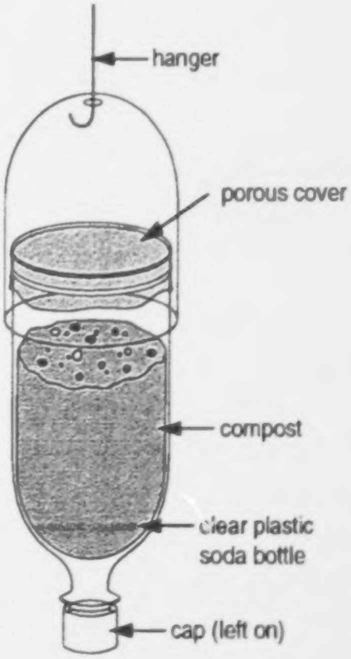
hanger
porous cover
compost
clear plastic soda bottle
cap (left on)

Figure 3.9.2 Compost Observation Bottle

3.9.3 ANIMALS IN COMPOST

OBJECTIVES

The students
- Observe changes in the compost.
- Observe animals found in the compost pile.

BACKGROUND

This activity continues the study of decomposition. The students collect samples to look for evidence of the presence of animals from their compost pile when they turn it. They continue to observe the changes occurring in the compost begun in Activity 3.9.1 MAKING COMPOST and hypothesize as to the causes for these changes.

This is a good time to do Activity 3.6.10 DISEASE TRANSMISSION to help the students make the connection between the growth of organisms in compost and in gelatin media.

STUDENT ROLES

Agronomist
Farmer

MATERIALS

compost
pitchfork or trowel
newspaper or trays
hand lenses
Student Page 3.9.3 COMPOST ANIMALS

PRODUCT

Completed Student Pages

BEST COPY AVAILABLE

PROCEDURES

1. **Each time the compost pile is turned have the students remove one– to two–liter samples of the compost material from the surface and deep inside. Have them put the material on newspaper or trays and inspect it with magnifying lenses. Have them record their observations on SP 3.9.3 COMPOST ANIMALS**

   Ask such questions as these:
   - Can you still identify the materials that are decomposing?
   - What does the compost feel like?
   - What does it smell like?
   - Does anything seem to be growing on the compost? How can you tell?
   - Does there seem to be any color change in the compost? If so, what seems to cause it?
   - Are there any animals in the compost? What kinds of animals did you find? What are they doing? What do you think their role is in the composting process?

2. **Have the students return the compost to the pile and clean up.**

3. **After the decomposition is complete and the compost is ready for use, have the class summarize their observations.**

   Ask such questions as these:
   - What happened to materials that were composted?
   - What happened to the feel of the materials? What might have caused this?
   - What happened to the smell of the compost?
   - What happened to things that seemed to grow on the compost?
   - What happened to the color of the compost? What might have caused this?
   - What happened to the animals in the compost pile?

EXTENSION

- Compare the changes in the compost pile to those in the Compost Observation Bottles.

3.9.4 USING COMPOST

OBJECTIVES

The students
- Discuss the reasons for using compost in garden soil.
- Invent ways of working compost into the soil.
- Compare soil with and without compost added.
- Revise their working definition of soil.

BACKGROUND

The students build on activities done in grade two where they compared soils made from crushed rock with natural soils.

In this activity the students discuss what constitutes good growing soil. It should have humus, an organic material composed of decayed plants and animals; the soil nutrients and chemicals plants need to grow; and a loose, grainy texture. Clay soils need to be aerated with chunky materials such as sand, vermiculite, perlite, finely ground pumice, or Styrofoam.

A good growing media is produced by adding the compost made by the students to soil. Usually a 5-centimeter or 2-inch layer of compost worked into the soil is adequate. The students invent ways to work the compost into the soil. Activity 3.10.1 ACIDIC AND BASIC SOIL should be done before planting.

STUDENT ROLE

Agronomist
Farmer
Gardener

BEST COPY AVAILABLE

MATERIALS

compost
shovels
rakes
Working Dictionary
Student Page 3.9.4 SOIL AND COMPOST

PRODUCTS

Composted garden soil
Completed Student Pages

PROCEDURES

1. **Discuss the use of compost in the garden with the class.**

   Ask such questions as these:
   - Why do we make compost?
     ✔ Work toward the idea that compost is a soil conditioner.

   - What did we put in the compost?
     ✔ List the ingredients. Help the students to note that food materials and animal waste will provide the nutrients or fertilizer that plants need.

   - Where should we put the compost?
     ✔ Help the students explore the idea that the plants will need to get their roots into the compost so it should be mixed into the soil.

   - How could we work the compost into the soil?
     ✔ Have the students invent ways. Help them with such ideas as raking it into loose soil, spading it in, etc. If a Rototiller is available, the process can be done by machine.

2. **Have the students add the compost to the garden soil.**

   Have them
   - Collect a sample of the soil before the compost is added.

   - Discuss and organize a way to spread the compost and work it into the soil.

   - Carry out their plan.

- Collect a sample of the soil after the compost is added.

3. **Have the students compare the soil texture before and after the compost is added. Use SP 3.9.4 SOIL AND COMPOST.**

   Ask such questions as these:
   - What differences in texture are there in the soil before and after the compost is added?
   - What differences do you see in the soil with and without the compost?
   - What other differences are there?

4. **Have the students revise their working definition of soil. Record their revisions in the Working Dictionary.**

EXTENSION

- Have the students research to discover what kinds of soil amendments are used by gardeners. (A garden shop is a good source of information.)

3.9.5 FALL UNEARTHING AND BURIAL

OBJECTIVES

The students

- Use a map to locate their fall burial site and retrieve the buried materials.
- Record their observations of decomposition of the buried materials.
- Summarize their decomposition studies to date.
- Hypothesize as to better ways to prevent the decomposition of grass clippings, wood, and iron.
- Map their new burial site.

BACKGROUND

This activity is done in early fall. The students unearth the materials they buried at the end of the second grade. They have been observing how several categories of things decompose. In kindergarten they began with paper, plastic, metal, and other unprotected materials. In first grade they attempted to protect iron and wood from decomposing as a final project. At the end of the second grade the students were challenged to protect grass clippings.

After the class summarizes their decomposition studies to date, they consider what else they could do to preserve grass cuttings, wood, and iron if these have shown decomposition. They then plan an experiment to prevent fruit from decomposing and rebury their materials until spring.

STUDENT ROLES

Agronomist
Chemist

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MATERIALS

rubber gloves or plastic bags
small sticks
hand lenses
materials to bury
plastic-mesh bags or nylon stockings
labeling materials
protective materials as requested
shovel
map of the grade two burial site
list of items buried in grade two (SP 2.9.4 PRESERVATION)
Student Pages 3.9.5A FALL UNEARTHING
3.9.5B FALL BURIAL

PRODUCTS

Protected materials
Map of new burial site
Completed Student Pages

PROCEDURES

1. **Have the students retrieve the records of the materials that were buried at the end of grade two and the map of the burial site.**

   Ask such questions as these:
   - What does the record tells us was buried? Does everyone agree?
     ✔ Discuss any disagreements.

   - Where is the burial site located? Does everyone agree?
     ✔ Discuss any disagreements.

   - What do you predict will be the condition of various items? Record predications.
     ✔ Use Student Page 3.9.5A FALL UNEARTHING.

2. **Have the students locate and dig up the materials buried in the second grade.**

   Have them
   - Use rubber gloves, sticks, and hand lenses to examine the material.

- Record their observations on Student Page 3.9.5A FALL UNEARTHING.

Ask such questions as these:

- How can we improve our mapping of the burial site?
- How did your predictions compare with what you actually found?
- What materials have changed the least?
- What materials have changed only a little?
- What happened to the paper, plastic, metal, and other materials buried in kindergarten?
- What happened to the things you attempted to preserve?
- What happened to the protected iron and wood?
- What happened to the grass?
- How would you change your preservation methods?
- How would you prevent fruit from decomposing when it is buried in the ground?

3. **Discuss with the students that in addition to improving their methods of protecting wood, iron, and grass, they will add fruit to the list of things they want to keep from decomposing.**

Have student groups

- Decide which groups will handle the different parts of the activity.
- Set a time for reburying.
- Save old material for reburial.
- Decide on any new materials to be added to their burial collection.
- Map the new burial spot.

- Use Student Page 3.9.5 FALL BURIAL to list the materials to be buried.

4. **Have the students prepare their materials for burial, bury them, and map the location of their burial site.**

   Have the groups
   - Invent ways to protect and label their assigned materials.
   - Record their predictions and protection methods on SP 3.9.5B FALL BURIAL.
   - Store their maps and student pages in their SCIENCE RECORD BOOKS for the spring unearthing.

EXTENSION

- Have the students research the preservation of fruits and meats.

3.9.6 SPRING UNEARTHING AND BURIAL

OBJECTIVES

The students
- Use a map to locate their fall burial site.
- Record their observations of the decomposition of the buried materials.
- Summarize their decomposition studies to date.
- Hypothesize as to better ways to prevent the decomposition of wood, iron, grass clippings, and fruit.
- Map their new burial site.

BACKGROUND

This activity is done in late spring. The students unearth the materials they buried at the beginning of third grade and summarize their decomposition studies to date. They consider what else they could do to preserve grass cuttings, wood, iron, and fruit if these have shown decomposition. They then plan an experiment to prevent meat from decomposing and rebury their materials until fall.

STUDENT ROLES

Agronomist
Chemist

MATERIALS

map of burial site
shovel
plastic bags or gloves
small sticks
Student Pages 3.9.5B FALL BURIAL
3.9.6 SPRING BURIAL

PRODUCT

Completed Student Pages

BEST COPY AVAILABLE

PROCEDURES

1. Have the students discuss the records of the materials that they buried in the fall of grade three. See Student Page 3.9.5B FALL BURIAL.

Ask such questions as these:

- What does the record tell us was buried?
- What do you predict will be the condition of the materials? Record any new or revised predications on Student Page 3.9.5B.
- Where is the burial site located? Have the class locate and dig up the buried materials.

2. Have the class locate and dig up the second grade buried materials.

Have them
- Use rubber gloves, sticks, and hand lenses to examine the material.
- Record their observations on Student Page 3.9.5B.

Ask such questions as these:
- How can we improve our mapping of the burial site?
- How did your predictions compare with what you actually found?
- What materials have changed the least?
- What materials have changed only a little?
- What happened to the paper, plastic, metal, and other materials buried in kindergarten?
- What happened to the things you attempted to preserve?
- What happened to the protected iron and wood?
- What happened to the protected grass and fruit?
- How would you change your preservation methods?

- How would you prevent meat from decomposing when it is buried in the ground?

3. **Discuss with the students that in addition to improving their methods of protecting wood, iron, grass, and fruit, they will add meat to the list of things they want to keep from decomposing.**

   Have student groups
   - Decide which groups will handle the different parts of the activity.
   - Set a time for reburying.
   - Save old material for reburial.
   - Decide on any new materials to be added to their burial collection.
   - Map the new burial spot.
   - List the materials to be buried.

4. **Have the students prepare their materials for burial, bury them, and map the location of their burial site.**

   Have the groups
   - Invent ways to protect and label their assigned materials.
   - Record their predictions and protection methods on SP 3.9.6 SPRING BURIAL.
   - Store their maps and student pages in their Science Record Books for fall unearthing in grade four.

EXTENSION

Have the students research the preservation of milk and eggs.

DASH

COMPOST OBSERVATIONS SP 3.9.1

Name: ______________________

Date: ______________________

DATE	TEMPERATURE	ODOR	COLOR	TEXTURE	OTHER OBSERVATIONS

DASH

COMPOST IN A BOTTLE
SP 3.9.2

Name: ______________________

Date: ______________________

DATE	TEMPERATURE	ODOR	COLOR	TEXTURE	OTHER OBSERVATIONS

DASH

COMPOST ANIMALS SP 3.9.3

Name: ____________________

Date: ____________________

DATE	ANIMALS FOUND	OBSERVATIONS

DASH

SOIL AND COMPOST
SP 3.9.4

Name: ______________________

Date: ______________________

SOIL OBSERVATIONS	
WITH COMPOST	WITHOUT COMPOST

SP 3.9.5A

DASH

FALL UNEARTHING
SP 3.9.5A

Name: ______________________

Date: ______________________

THINGS BURIED	PREDICTIONS	OBSERVATIONS

DASH

FALL BURIAL
SP 3.9.5B

Name: ____________________

Date: ____________________

DATE OF BURIAL

LOCATION

THINGS BURIED	METHOD OF PROTECTION	PREDICTIONS	OBSERVATIONS

DASH

SPRING BURIAL
SP 3.9.6

Name: ______________________

Date: ______________________

DATE OF BURIAL			
LOCATION			
THINGS BURIED	METHOD OF PROTECTION	PREDICTIONS	OBSERVATIONS

DASH

GRADE THREE
CLUSTER 10

MATTER, SPACE, AND CONSTRUCTION

3.10.1	Acidic and Basic Soil
3.10.2	Acids and Bases
3.10.3	Acid and Base Reactions
3.10.4	Diluting Acids and Bases
3.10.5	Acid and Base Interaction
3.10.6	Dissolving Things
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3.10.8	Crystals
3.10.9	Rain in a Jar
3.10.10	Supermarket Planning
3.10.11	Supermarket Construction
3.10.12	Measuring Devices
3.10.13	Safety Equipment

3.10.1 ACIDIC AND BASIC SOIL

OBJECTIVES

The students
- Discover that certain garden plants do not grow well in overly acidic or basic soils.
- Practice using pH paper to measure the acidity and basicity of soil.
- Invent a way to use hydrion paper to measure the pH of soil.
- Research to find out what must be done if the soil is too acidic or basic.

BACKGROUND

This activity is done with Activity 3.9.4 USING COMPOST. The activity's first purpose is to ensure that the soil will have a proper pH range to grow a good garden crop. The second purpose is to introduce the students to acids and bases. The students begin the activity by reading the references to acid and basic soils on seed packets.

The pH indicator, hydrion paper, is used in this activity since it can be used for many other experiments and is inexpensive. The term "pH" is an abbreviation for **potential hydrogen**. Potential hydrogen refers to the amount of hydrogen ions there are in a solution. If there are a lot of hydrogen ions, the pH is in the 1–2 range and the solution is strongly acid. If there are very few hydrogen ions, the solution is basic. A strong basic solution is in the 13–14 range. Most tap water is in the middle of the range at 7 and is said to be neutral.

Instructions for using hydrion paper are usually found on the container. Dip a small amount of paper in a water solution of the thing to be tested and match the color against the color chart that comes with the paper. The pH is read directly from the color scale. To conserve hydrion paper, use very small pieces.

After compost is added, most soils will be in a pH range that will grow good garden crops If the soil is too acid, lime can be added. Soil that is too basic can be treated chemically, but this is expensive. Consult a local garden supply store for suggestions.

STUDENT ROLES

Agronomist
Farmer
Gardener

MATERIALS

Wonder and Discover Book
seed packets that reference acid and basic soils
acid solution (15 mL (1 tablespoon) vinegar in 250 mL (1 cup) water)
base solution (15 mL (1 tablespoon) liquid soap in 250 mL (1 cup) water)
hydrion paper
soil samples
newspaper
water
Student Page 3.10.1 ACIDIC AND BASIC SOIL

PRODUCTS

Good garden soil
Completed Student Pages

PROCEDURES

1. **Introduce acids and bases by having the students read seed packets that address the problem of acidic and basic soils.**

   Ask such questions as these:
   - Does anyone know what an acid or basic soil is?
     ✔ If there are no answers, put the question in the Wonder and Discover Book.

   - Has anyone ever used a soil-test kit to find how acidic or basic soil is?

2. **Demonstrate the use of hydrion paper to find the acidity and basicity of different water solutions. Introduce the color code and pH scale.**

   Have the students
   - Test the pH of tap water with hydrion paper.

   - Record on SP 3.10.1 ACIDIC AND BASIC SOIL.

- Compare their findings.
  ✓ Should be around pH 7.

- Test and record the pH of the acid solution.
  ✓ Vinegar solution.

- Compare their findings.
  ✓ Should be in the 3–5 range.

- Test and record the pH of a base solution.
  ✓ Soap solution.

- Compare their findings.
  ✓ Should be in the 9–12 range.

3. **Have the students invent and test a way to find the pH of their soil samples.**

   Ask such questions as these:
   - Hydrion paper is used to find the pH of things in a water solution, so how might we check the pH of soil?
     ✓ Work to the idea of putting water on the soil and testing the water.

   - A lot of water will wash away some of the acid or base, so how might we test the pH of soil?
     ✓ Work to the idea of placing the hydrion paper on slightly moistened soil.

4. **Have the students measure the pH of their garden soil. The compost should have been added to the soil previously.**

   Ask such questions as these:
   - How did you keep from getting the paper so muddy that you could not read the color?
     ✓ Some students may have found that water goes through the paper, giving the color to both sides.

   - Did everyone get the same reading?
     ✓ There should be a fairly narrow range unless the students use a large amount of water.

   - Now that we know the pH, is the pH of the soil right for the things we wish to plant?
     ✓ See the seed packets.

- If not, what can we do? Where can we find out what to do? ✔ Work toward asking someone at a garden shop, talking to gardeners, reading a gardening book, etc.

5. **If pH changes need to be made, have the students do some research and add the necessary materials to their garden soil.**

EXTENSION

- Have the students research to find out what pH means.

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3.10.2 ACIDS AND BASES

OBJECTIVES

The students
- Make their own hydrion paper acid-base color scale.
- Make safety equipment to wear when handling acids and bases.
- Test the pH of various substances found in the classroom and at home.
- Compare and rank order the pH of the substances they test.

BACKGROUND

This is the second activity in the acid-base series. The students make hydrion acid-base color scales by matching colors to the standard that comes with the hydrion (pH) paper. They need to use a wide-spectrum crayon or colored pencil collection. Student groups compare their color selections to assure standard results when they use their acid-base scales to test the acidity and basicity (alkalinity) of different things in the classroom.

To test dry solids, put a small amount of the solid in water, stir, and then test the water. Chalk dust can be tested this way.

Small pieces of hydrion paper will usually give good color tests. The pieces should be .5 cm wide and sufficiently long so that the students don't touch the substances being tested. Alternatively, the pH paper can be held with a wooden clothespin or students may wear plastic gloves. The color change of the hydrion paper should be read within seconds of touching the substance since the color may fade over time. Hydrion or pH paper is not poisonous, but it should NOT be put in the mouth.

Safety is an important factor to consider whenever students are handling chemicals. Discuss safety procedures with the students. Be sure to include the need to wear **goggles** and plastic **aprons**. If students get an acid or base on their skin or clothes they should wash the area with plenty of water and tell the teacher. Although the chemicals used in this activity are not likely to burn either skin or clothing, good safety procedures should **always** be followed.

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Directions for making eye safety shields and aprons are in Activity 3.10.13 SAFETY EQUIPMENT. Standard safety goggles may also be used.

The materials suggested for use in these activities have pHs in the range of 1–12. Any substance with a pH above 12 is quite caustic and should be handled **only** by the teacher. It takes a considerable amount of water to flush away these strong bases. Skin and clothing will feel slippery as long as the base is present.

STUDENT ROLES

Chemist
Safety engineer

MATERIALS

chart paper
markers
crayons or colored pencils
wide-spectrum hydrion paper
goggles (See Activity 3.10.13 SAFETY EQUIPMENT)
aprons (See Activity 3.10.13 SAFETY EQUIPMENT)
wooden pinch-type clothespins
plastic gloves
small containers to hold samples for testing
eyedroppers
substances to test
Student Page 3.10.2 ACIDS AND BASES

PRODUCTS

Class chart of acids and bases
Completed Student Pages

PROCEDURES

1. Have the students make a hydrion scale color chart.

Have them
- Match the colors on the scale with their crayons or colored pencils.
  ✔ Get class agreement.

- Make their own color charts using Student Page 3.10.2 ACIDS AND BASES.

- Compare their charts within their own groups and between groups to be sure all charts are the same.

2. **Discuss with the class the need for safety when handling chemicals.**

   Include such things as
   - Wearing goggles or a safety shield to protect their eyes.

   - Wearing aprons to protect clothing.

   - Using wooden clothespins or plastic gloves to handle pH paper.

   - Washing the skin with lots of water if any chemical gets on it.

   - Washing clothing or other surfaces if any chemical is spilled on them.

   - Reporting to the teacher if a chemical is spilled on skin, clothing, tables, floor, or on anything.

3. **Have the students make any needed safety equipment. See Activity 3.10.13 SAFETY EQUIPMENT.**

4. **Give each student several small pieces of hydrion paper. Have the students test common substances found in the classroom and at home. Dry solids can be tested in a water solution. Caution them NOT to put their fingers in any caustic or toxic substances they might test. Have them wear goggles and aprons.**

   Have the students test such things as
   - Saliva
     ✔ Spit and test the liquid. DO NOT put the hydrion paper in the mouth.

   - Sweat

   - Water

   - Various soaps

   - Alcohol

- Bleach
- Salt
- Fruits
- Vegetables
- Milk
- Meats
- Oil

5. **Have the students summarize their test results. Make a class chart on acids and bases.**

Have them
- Use a pH scale of 1 to 14 to record test results.
- Label the point where things move from acid to base.
  ✔ This is the center neutral point of 7.
- Label the end of the scale with the greatest concentration of acid.
  ✔ This is the low or 1 end of the scale.
- Label the end of the scale with the greatest concentration of base.
  ✔ This is the high or 14 end of the scale.

6. **Have the class discuss their findings.**

Ask such questions as these:
- Which substance that you tested had the lowest pH?
- Which substance that you tested had the highest pH?
- What is the point on the scale where things go from acid to base?
  ✔ This is pH 7. Things with a pH 7 are called **neutral** substances.
- What thing(s) did you test that had a pH of about 7?
  ✔ Water and table salt or sugar solutions have pHs of about 7.

- What were the pHs of most of the living things you tested?
  ✔ Most are acid to neutral.

EXTENSIONS

- Set up an acid-base testing center. Have the students test and record the pH of additional substances they collect.
- Have the students research to find what acids and bases are used in cooking.
- Have the students investigate the use of red cabbage extract, litmus paper, and other acid-base indicators to test for acids and bases.

3.10.3 ACID AND BASE REACTIONS

OBJECTIVES

The students
- Investigate the reaction of various substances with acids.
- Investigate the reaction of various substances with bases.
- Observe the change in pH during reactions.

BACKGROUND

This is the third activity in the acid-base series. The students observe how an acid and a base react with different kinds of materials. White vinegar is the acid used and a dishwasher soap solution is used as the base. These are strong chemicals and should be handled with care. Alternatively, lemon or lime juice can be used as the acid and a limewater or strong soap solution as the base.

Dishwasher soap, limewater, lemon or lime juice, and vinegar are irritants and can burn the hands and clothing if not washed off quickly with plenty of water. **Goggles** and a **plastic apron** should **always** be worn when handling these chemicals.

To prepare the base solution, dissolve 25 mL (5 teaspoons) of dishwasher soap in 250 mL (1 cup) of water in a glass jar. Do not mix in a metal container. Shake thoroughly and let the solution stand overnight. Skim off any film from the top. Pour the clear liquid into a clean jar and label it Standard Base Solution. To make limewater add builder's lime, calcium hydroxide ($Ca(OH)_2$), to water until no more will dissolve. Shake well and allow the solution to stand for 24 hours. Pour off the clear liquid (limewater) and keep it in a tightly closed glass container until needed.

Use undiluted white vinegar (acetic acid) or strained lemon or lime juice (citric acid) as the acid in this activity.

To test materials in acids and bases, pour 10–20 mL of the acid or base solution into a small glass jar. The jar is the reaction chamber. Do not put lids on the chambers because opening may result in spills. Some items for testing are listed in the following chart. Students may add other items to the list.

ITEM	Expected Reactions	
	In Acid Solution	In Base Solution
Meat	Changes color and texture	Changes color and texture
Cloth	Weakens or disintegrates	Weakens or disintegrates. Bases strengthen cotton fabric in a process called mercerizing.
Baking soda (Sodium bicarbonate)	Forms a gas	No reaction
Milk	Curdles	Curdles
Fat	Changes color and texture	Turns pasty
Vegetables	Change color and texture	Change color and texture
Galvanized nail	Produces a gas and changes color	No reaction
Paper clip	Produces a gas and changes color	No reaction
Aluminum foil	No reaction	May form gas
Piece of tin can	Changes color if scratched	No reaction
Limestone	Produces a gas	No reaction
Copper sulfate	No reaction	Forms a precipitate

This activity can be done as a demonstration with some class participation. Ideally a pair of students will be responsible for each jar, its contents, and its observation. When the students handle or observe the contents closely they should wear aprons and goggles. Students can make their own aprons from heavy plastic bags. A student-made safety helmet can be used in place of goggles. See Activity 3.10.13 SAFETY EQUIPMENT.

If students get either acids or bases on their clothes or any part of their bodies, including eyes, wash with large quantities of running water.

These chemicals can be disposed of in the sink. Neither the acid or base solutions used in this activity will affect the plumbing or pollute the sewer system.

STUDENT ROLE

Chemist

MATERIALS

goggles (See Activity 3.10.13 SAFETY EQUIPMENT.)
plastic aprons (See Activity 3.10.13 SAFETY EQUIPMENT.)
white vinegar (acetic acid) or lemon or lime juice (citric acid)
dishwasher soap or builder's lime ($Ca(OH)_2$)
water
measuring containers (See Activity 3.10.12 MEASURING DEVICES.)
baby food or small glass jars (2 for each material to be tested)
glass jars for acid and base stock solutions.
materials to be tested
hydrion or pH paper
Student Page 3.10.3 ACID AND BASE REACTIONS

PRODUCT

Completed Student Pages

PROCEDURE

1. **Introduce the class to the idea of investigating what acids and bases do to the things around us. Discuss the safe use of acid and base solutions.**

   Ask such questions as these:
   - Does anyone have an idea about what an acid or a base might do to our clothes or skin?
     ✓ Work to the idea that it can burn them.

   - How can we protect ourselves?
     ✓ Get at the need to wear eye protection and aprons.

   - What should we do if we get an acid or a base on us?
     ✓ Wash it off with lots of water and tell the teacher.

   - What could we put acids and bases in to handle them?
     ✓ Work to the idea of using glass or plastic containers.

- What do you want to observe acids and bases reacting with?
  ✓ Introduce the word **reacting** as referring to what happens when things come in contact with each other.

2. **Have the students list and collect the materials they want to observe reacting with acids and bases.**

   Help them include such things as
   - Meat
   - Cloth
   - Baking soda
     ✓ sodium bicarbonate
   - Milk
   - Fat
   - Vegetables
   - Galvanized nail
   - Paper clip
   - Piece of aluminum
   - Piece of tin can
   - Limestone
   - Copper sulfate

3. **Have the students wear goggles and aprons to investigate the acid reactions. Have each pair pour 10–20 mL of the acid into a baby food jar. Then have them add their material to the jar and observe what happens. Use SP 3.10.3 ACID AND BASE REACTIONS.**

   Have them make and record such observations as
   - Starting pH using hydrion paper.
   - Changes in the material after 10 minutes
   - Changes in the pH after 10 minutes

- Changes in the material every hour until the end of the day.
- Changes in the pH every hour until the end of the day.
- Changes in the material over night.
- Changes in the pH overnight.

4. **Have the students slowly fill the baby food jars with water and remove their materials. Have them test the materials to see whether they recorded all the changes that occurred.**

5. **Have the students wear goggles and aprons to investigate base reactions. Have each pair pour 10–20 mL of the base solution into a baby food jar. Then have them add their materials to the jar and observe what happens.**

   Have them make and record such observations as
   - Starting pH using hydrion paper.
   - Changes in the material after 10 minutes.
   - Changes in the pH after 10 minutes.
   - Changes in the material every hour until the end of the day.
   - Changes in the pH every hour until the end of the day.
   - Changes in the material overnight.
   - Changes in the pH overnight.

6. **Have the students slowly fill the baby food jars with water and remove their materials. Have them test the materials to see whether they recorded all the changes that occurred.**

7. **Summarize the activity with the class.**

   Ask such questions as these:
   - What happened to the pH of the base over the day and night?
     ✓ It should have gotten lower—closer to the neutral 7.
   - What does this mean?
     ✓ Work to the idea that the base gets weaker. There is less and less base.

- What happened to the pH of the acid over the day and night?
  ✔ It should have gotten higher—closer to the neutral 7.

- What does this mean?
  ✔ Work to the idea that the acid gets weaker. There is less and less acid.

- What happened to each of the items in the jars?
  ✔ With most materials there will have been some reaction with the acid, the base, or both.

EXTENSIONS

Have the students

- Research other kinds of acids and bases.

- Set up an acid and base reaction center to test other substances. This should be done under direct teacher supervision. Seal the baby food jars with lids. Only the teacher should open the jars for cleaning and emptying.

3.10.4 DILUTING ACIDS AND BASES

OBJECTIVES

The students

- Simulate acid and base dilution and concentration.
- Test the effects of varying dilutions of acid on sodium bicarbonate.
- Develop working definitions for dilution and concentration.

BACKGROUND

This is the fourth activity in the acid-base sequence. The students work with the processes of dilution and concentration and then apply these ideas to an acid and a base. Working definitions are developed for dilution and concentration.

In the first part of the sequence the students are asked to make judgments about the concentration of a drink syrup. The tongue is relatively poor judge of concentration, unless it is "cleansed" by having something like a small piece of cracker between tastes.

Undiluted white vinegar (acetic acid) or lemon or lime juice (citric acid) is used as the standard acid. These all have a pH in the 2–3 range. To make the standard base solution, see Activity 3.10.3 ACID AND BASE REACTIONS. This solution should have a pH in the range of 11–13.

The students should always wear **goggles** and **aprons** when working with chemicals. If they get any of the acid or base on themselves, wash the area quickly with plenty of water.

Although the chemicals used in this activity are unlikely to cause any problems, it is always best to use correct procedures when handling any chemicals. Acids should be added to water.

STUDENT ROLE

Chemist

MATERIALS

concentrated drink syrup
soda crackers
small plastic or paper cups
clean stirrers
clean water containers
dishwasher soap
baking soda (sodium bicarbonate)
white vinegar (acetic acid)
small glass jars (four per group)
small graduated containers (See Activity 3.10.12 MEASURING DEVICES)
goggles (See Activity 3.10.13 SAFETY EQUIPMENT)
aprons (See Activity 3.10.13 SAFETY EQUIPMENT)
masking tape
waterproof fine-line markers
hydrion (pH) paper
Working Dictionary
Student Page 3.10.4 DILUTING ACIDS AND BASES

PRODUCTS

Working definitions of dilution and concentration
Completed Student Pages

PROCEDURES

1. **Introduce the class to the concepts of dilution and concentration using a concentrated drink syrup in a guided inquiry activity. Use SP 3.10.4 DILUTING ACIDS AND BASES.**

   Have the students
   - Wash their hands.
   - Pour 1–2 milliliters (1/4 teaspoon) of syrup into cups (one for each student).
   - Taste the undiluted syrup.
   - Answer the question how does the syrup taste?
     ✔ Some students will say it is too sweet.

- Answer the question how could we make the syrup less sweet?
- Test their techniques by adding water.
- Measure how much water it takes to get the syrup to taste "just right."
- Compare the amounts of water that were added to the syrup.
  ✔ Amounts will vary with students' individual tastes.
- Answer the question how did you change the taste?
  ✔ Added water.
- Answer the question did anyone stir the water and syrup? Why?
  ✔ Explore the idea that the syrup has to be mixed or spread out in the water.
- Answer the question what did this do to the syrup?
  ✔ Work toward the idea that there was less syrup in each sip taken.
- Taste several different samples of "just right" diluted syrup.
- Answer the question do the different samples taste the same or different?
  ✔ Work to an agreement that samples from the same diluted syrup taste about the same.
- Answer the question does anyone know what the spreading of the syrup throughout the liquid is called?
  ✔ Introduce the term **dilute**.
- Answer the question does anyone know the antonym or the opposite of dilute?
  ✔ Introduce the term **concentrate.**
- Discuss the question how could we concentrate a dilute drink solution?
  ✔ Work toward the idea mixing more syrup into the dilute solution.
- Add syrup to their diluted drink.
- Taste the solution to see what happens.

- Answer the question what happened to the taste?
  ✔ Pursue the idea that it gets sweeter as the syrup gets more concentrated.

2. **Introduce the students to the concept of diluting acids and bases.**

   Ask such questions as these:
   - What do we do when we spill an acid or a base on our hands or clothes?
     ✔ Wash them with water.

   - When we wash our hands or clothes with water, what happens to the acid or base?
     ✔ Get at the idea of dilution. Adding water to the acid or base spreads it through the water.

   - How is this like diluting the syrup solution?
     ✔ Discuss the idea that in both cases we are spreading out the acid, base, or syrup in water.

   - What do you think diluting does to the ability of the acid or the base to burn us?
     ✔ Point out that this is something that won't be intentionally tested.

3. **Simulate dilution by having the students represent particles of acid and desks represent the container of water.**

   Have four students sit on top of one desk.

   Ask such questions as these:
   - How many particles of acid are there?
     ✔ Four.

   - How much water is there?
     ✔ One container.

   - How could we show dilution?
     ✔ Work to the idea of adding more water or desks.

   - When more water is added, what happens to the acid particles?
     ✔ They spread out.

   - How could we show this in the simulation?
     ✔ Add one more desk, then add two more desks.

- In the simulation what happened to the acid particles?
  ✓ They spread evenly among the desks.

- How could we show concentration in the simulation?
  ✓ Add more acid or students to each desk.

- How does this connect with our experiment on dilution and concentration of drink syrup?
  ✓ They spread out the syrup by adding water to it. Discuss the idea that in any sample of syrup, acid, or base there are billions of very tiny syrup, acid, or base particles, making it easy to spread them around.

4. **Have student groups make several different dilutions of an acid and find the pH of each. Use SP 3.10.4 DILUTING ACIDS AND BASES to record data.**

   Have them
   - Wear **goggles** and plastic **aprons**.
   - Pour 100 mL of the standard acid (undiluted white vinegar) into a small jar.
   - Check the pH and mark it on the jar. Label this jar #1.
   - Take 10 mL of the acid from jar #1 and pour it into another small jar containing 90 mL of water. Then stir the ingredients.
   - Check the pH and mark it on the jar. Label this jar #2.
   - Take 10 mL of the acid from jar #2 and pour it into another small jar containing 90 mL of water. Then stir the ingredients.
   - Check the pH and mark it on the jar. Label this jar #3.
   - Take 10 mL of the acid from jar #3 and pour it into another small jar containing 90 mL of water. Then stir the ingredients.
   - Check the pH and mark it on the jar. Label this jar #4.

5. **Have the students repeat Procedure 4 using a base (10 mL of dishwasher soap dissolved in 100 mL of water.)**

6. **Have the class summarize the dilution activities.**

Ask such questions as these:

- Which jar of acid is most dilute? Why?
  ✔ Work to an agreement that the last one, #4, is the most dilute because we added the most water to it. Jar #3 is less dilute and #2 is still less dilute.

- How can we check on our answer to the question of the most dilute?
  ✔ Work to the idea of checking the pH. As the pH of the acid gets closer to 7, it is more dilute.

- Which of the bases is most dilute? Why?
  ✔ Work to an agreement that the last one, #4, is the most dilute because we added the most water to it. Jar #3 is less dilute and #2 is still less dilute.

- How can we check on our answer to the question of the most dilute?
  ✔ Again work to the idea of checking on the pH. As the pH of the base gets closer to 7, it is more dilute.

- What were some of the things that acids did that bases did not do that could be used to tell when we have an acid?
  ✔ Use data from Activity 3.10.3 ACID AND BASE REACTIONS. Call attention to the reaction of metals and baking soda with acid that produced gases.

- Which of the gas reactions was the fastest?
  ✔ The sodium bicarbonate reaction. Repeat it if necessary.

- What would you predict will happen if we have 5 mL of a dilute acid and 5 mL of a concentrated acid and into each we pour 5 mL of sodium bicarbonate?

7. **Have student groups test the reactions of different dilutions of acid on sodium bicarbonate.**

Have them

- Wear protective eyeware and aprons.

- Measure two samples of 5 mL of sodium bicarbonate and put into two separate jars.

- Measure 5 mL from jar #1, concentrated acid, and 5 mL from jar #4, dilute acid, into separate containers.

✔ Film cans work well.

- Simultaneously pour one sample of acid into one jar and the other into the second jar. Stir the mixtures until all reaction stops.

- Observe and record on SP 3.10.4 what happens when the acid and the sodium bicarbonate are mixed.

8. **Have the class summarize the reactions of different concentrations of acid with sodium bicarbonate.**

Ask such questions as these:

- Was there any difference in the reactions? If so what was it?
  ✔ One reaction was "bigger" than the other.

- How can you tell?
  ✔ Get at the observation that there is more sodium bicarbonate left in one than the other.

- Which was the bigger reaction?
  ✔ The one with the more concentrated acid.

- What else could we do to check the reaction?
  ✔ Have student groups invent their own techniques. One group should try putting pH paper into the diluted and the concentrated acids. Have all groups report their results.

- What do you think would happen if we poured 5 mL of acid from jar #2 into 5 mL of sodium bicarbonate? Jar #3?
  ✔ Have the students make predictions about the relative amounts of sodium bicarbonate that will be used.

9. **Have student groups test their predictions using equal amounts of all four acid dilutions on equal amounts of sodium bicarbonate.**

Have them record their predictions and results on SP 3.10.4.

Ask such questions as these:

- How good were your predictions?

- Was there any difference in the reactions? If so what was it?
  ✔ Work to the idea that some reactions were bigger than others.

- How can you tell?
  ✔ Get at the observation that there are varying amounts of sodium bicarbonate left in each reaction.

- Which was the biggest reaction?
  ✔ The one with the most concentrated acid.

- Which was the strongest acid and which was the weakest?
  ✔ Get an agreement that the jar with the lowest pH is the strongest because it is able to react with the most sodium bicarbonate.

- What does pH seem to measure?
  ✔ Work to the idea that it tells us about the strength of the acid or base.

10. **Have the students develop working definitions for dilution and concentration. Record them in their Working Dictionary.**

EXTENSIONS

- Set up a dilution center and have students use other acids such as lemon juice and bases such as liquid soap to make pH predictions about diluting and concentrating.

- Have students invent a way to use sodium bicarbonate to determine the concentration of orange juice, lime juice, and other fruit juices.

3.10.5 ACID AND BASE INTERACTION

OBJECTIVES

The students
- Investigate the mixing of acids and bases.
- Develop a working definition of neutralization.
- Simulate the process of dilution.

BACKGROUND

This activity is an open exploration of what happens when an acid is mixed with a base. Several things occur that the students can observe and measure. The reaction will produce heat. If more acid than base is present, the pH will be on the acid side (less than 7) but less than the pH of the original acid. If more base than acid is present, the pH will be on the base side (more than 7) but less than the pH of the original base. The pH will be about 7 if equal quantities of equal concentrations and strengths of acid and base are mixed.

When a substance has a pH of 7, it is neutral. Water and salt solutions usually have a neutral pH of 7. The students are introduced to the process of **neutralization** through the mixing of acids and bases and testing for pH in this activity.

The students now have some experience in dealing with acids and bases. This activity gives them a chance to begin to form hypotheses about what might occur when they experiment. Before they do a test, have them predict what they think will happen.

This activity gives the students a complex problem to investigate. Initially limit the materials in the Inventor's Box to one acid (undiluted white vinegar), one base (10 mL of dishwasher soap dissolved in 100 mL of water), hydrion paper, student-made graduated containers, stirrers, small glass jars and water. **Goggles** and **plastic aprons** should always be worn when handling acids and bases. These are irritating substances and will burn skin and clothing if not washed off with water quickly.

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STUDENT ROLE

Chemist

MATERIALS

goggles (See Activity 3.10.13 SAFETY EQUIPMENT)
plastic aprons (See Activity 3.10.13)
acid (undiluted white vinegar, acetic acid)
base solution (10 mL of dishwasher soap dissolved in 100 mL of water)
hydrion paper
student-made graduated containers (See Activity 3.10.12 MEASURING DEVICES)
small glass jars
water
copper sulfate solution
sodium bicarbonate
index cards 3 in x 5 in
markers
Working Dictionary
Connections Book
Student Page 3.10.5 ACID-BASE INTERACTION

PRODUCT

Completed Student Pages

PROCEDURES

1. **Introduce the activity by asking what the students think will happen if an acid and a base are put together?**

   Have them
   - Describe the materials that are in the Inventor's Box.
   - Discuss what might happen to the pH.
   - Write their predictions on SP 3.10.5 ACID-BASE INTERACTIONS.
   - Invent ways to test their predictions.
   - Wear **goggles** and **aprons**.
   - Try their experiments and tests.

- Record their results and observations on SP 3.10.5.

2. **Discuss and summarize the results and observations of the students' experiments.**

Ask such questions as these:
- What happened when you mixed acids and bases?
- What were the pHs of the original solutions?
- What happened to the pH of the acid as base was added?
  ✔ Work to the idea that the pH got larger.
- What happened to the pH of the base as acid was added?
  ✔ Work to the idea that the pH got smaller.
- Did anyone observe anything about temperature? What did you record?
  ✔ The reaction generates heat.
- What do acids and bases seem to do when they interact?
  ✔ Work to the idea that the pH seems to move to the 7, the middle of scale. Introduce the name for the process, **neutralization.** Have the students define the word neutralization and record it in the Working Dictionary.
- How might dilution differ from neutralization?

3. **Have the class simulate the difference between acid and base dilution and acid-base reaction.**

Have the students
- Divide into two equal groups. Half are acids holding a card with an A on it. Half are bases holding a card with a B on it.
- Demonstrate how to dilute acids and bases.
  ✔ Review Activity 3.10.4 DILUTING ACIDS AND BASES.
- Discuss what happens to the pH of an acid each time it is diluted.
  ✔ It gets closer to 7 because the acid is spreading out and there is less acid in each mL.
- Discuss what happens to the pH of a base each time it gets diluted.

✔ It gets closer to 7 because the base is spreading out and there is less base in each mL.

- Change the simulation and discuss how they could show acids and bases joining together.
  ✔ Work to the idea of holding hands or linking arms.

- Sit in groups of two acids and two bases and show what happens when they react.
  ✔ They hold hands and become something new.

- Discuss why there are no acids or bases left over.
  ✔ They are all used up.

- Discuss what the pH is when there is no acid or base.
  ✔ Work for the middle of the scale, 7.

- Make other combinations to show partial neutralization, when there is some acid or base left over, and compare to complete neutralization, when there are equal numbers of acids and bases.

4. Have the class discuss what they know about acids and bases and record this in the Connections Book.

Ask such questions as these:
- Who needs to know about acids and bases?

- Where are acids and bases used?

- Why might information about diluting, mixing, or neutralizing acids and bases be important? Who might need this information?

EXTENSIONS

Set up a neutralization center.

Have the students
- Neutralize solutions with various pHs.

- Predict how much acid or base it will take.

- Search for a predictable and systematic way of doing this.

- Use less irritating acids (in the 3–6 range) and bases (in the 8–11 range.)
- Wear **goggles** and **aprons** when working at the center.

3.10.6 DISSOLVING THINGS

OBJECTIVES

The students
- Make a concept map about solutions and dissolving.
- Dissolve materials at different temperatures.
- Dissolve materials using different solvents.
- Develop working definitions for dissolve and solution.

BACKGROUND

This activity is the first in a series to introduce the processes of **dissolving**, **evaporation**, and **crystallization**. The terms **solid**, **liquid**, and **gas** should be reviewed and defined in working definitions if necessary. The students begin with a concept map of the term **solution**. As the activity progresses, have them add new ideas to their map so they will have a good source of information to use to write their working definition for **dissolve**.

The students work with a variety of common liquids and solids in this activity. Liquids can include such things as water, alcohol, cooking oil, liquid detergent, milk, vinegar, and soda. Solids that can be used include salt, sugar, baking soda, chalk dust, etc.

Safety is always a primary concern in DASH. The students should **always** wear aprons and goggles when they are mixing or pouring materials. Refer to Activity 3.10.13 SAFETY EQUIPMENT for further information.

STUDENT ROLE

Chemist

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MATERIALS

chart paper
markers
aprons (See Activity 3.10.13 SAFETY EQUIPMENT.)
goggles (See Activity 3.10.13 SAFETY EQUIPMENT.)
baby food jars
graduated containers (See Activity 3.10.12 MEASURING DEVICES.)
alcohol
water
soda
milk
vinegar
liquid detergent
cooking oil
salt
baking soda
sugar
chalk dust
ice
containers to hold ice baths
Working Dictionary
Student Pages 3.10.6A DISSOLVING THINGS
3.10.6B SOLUBILITY TESTING

PRODUCTS

Concept map about solution
Completed Student Pages

PROCEDURES

1. **Begin the activity by having the class make a concept map of the term solution.**

   Help the students include such ideas as
   - An answer to a problem.
   - A liquid with a another liquid mixed or dissolved into it.
   - A liquid with a solid dissolved in it.
   - A liquid with air or a gas dissolved in it.

2. **Discuss Problem 1, Exploring Liquids that Dissolve in Water, with the class.**

Ask such questions as these:

- How do you know whether something dissolves in water?
  ✔ Work toward two ideas: first seeing whether the substance goes into solution, and second, seeing whether the substance comes out of solution. Only the first idea will be explored in this activity.

- How could you tell whether one liquid is dissolved in another liquid?
  ✔ Work to the idea of putting known quantities of two liquids in a container and mixing them. Five mL of each liquid is a good starting quantity.

- What would you expect to see if one liquid completely dissolved in the other?
  ✔ Accept all answers.

- What would you expect to see if one liquid only partially dissolved in the other?
  ✔ Accept all answers.

3. **Have student groups test some common liquids to see which dissolve in water. Have them use SP 3.10.6A DISSOLVING THINGS to record their observations.**

Ask such questions as these:

- How did the liquids look before they were shaken?
  ✔ In some cases, one floated on the other.

- Which of the liquids completely dissolved in water?
  ✔ Work to class agreement.

- How did you know when a liquid completely dissolved in water?
  ✔ Pursue the idea that after shaking the liquids together, it looked like there was only one liquid. Add this idea to their concept map.

- Which of the liquids only partially dissolved in water?
  ✔ Work to class agreement.

- How did you know when a liquid only partially dissolved in water?
  ✔ Work to the idea that after shaking the two liquids, it looked like there was less of one liquid than before. Add this idea to the concept map.

- Which liquids did not seem to dissolve in water at all?
  ✔ Work to class agreement.

- How did you know when a liquid did not dissolve in water?
  ✔ Work to the idea that after shaking the two liquids it looked like there was the same amount of each liquid as before. Add this idea to the concept map.

4. **Discuss Problem 2, Exploring Solids that Dissolve in Water, with the class.**

   Ask such questions as these:
   - How can you tell whether a solid dissolves in a liquid?
     ✔ Get at the idea of putting known quantities of the solid and the liquid into a container and shaking them. Five mL of the solid and 10 mL of the liquid are good starting quantities.

   - What would you expect to see if the solid completely dissolved in the liquid?
     ✔ Accept all answers.

   - What would you expect to see if the solid only partially dissolved in the liquid?
     ✔ Accept all answers.

   - What would you expect to see if none of the solid dissolved in the liquid?
     ✔ Accept all answers.

5. **Have student groups test some common solids to see which ones dissolve in water. Have them use SP 3.10.6A DISSOLVING THINGS to record their observations.**

   Ask such questions as these:
   - How did your group test the dissolving of solids in water?

   - Which solids seem to dissolve in water?
     ✔ Work to class agreement.

- How did you know the solid completely dissolved in water?
  ✔ Work to the idea that no solid was visible. Add this idea to the concept map.

- Which solids seemed to only partially dissolve in water?
  ✔ Work to class agreement.

- How did you know the solid was only partially dissolved?
  ✔ Work to the idea that there was less solid than before mixing. Add this idea to the concept map.

- Which solids did not seem to dissolve in water at all?
  ✔ Work to class agreement.

- How did you know none of the solid dissolved in the water?
  ✔ Work to the idea that there seemed to be the same amount of solid after mixing as before. Add this idea to the concept map.

6. **Have student groups explore Problem 3, The Effect of Temperature on the Quantity of Sugar that Dissolves in Water. Use SP 3.10.6A DISSOLVING THINGS.**

Have the students

- Dissolve all the sugar they can in 15 mL of water at room temperature by adding measured amounts (5-mL increments) of sugar to the water, shaking, then adding more sugar and shaking until no more will go into solution.
  ✔ This is called a **saturated solution**.

- Discuss how they know when no more sugar will go into solution?
  ✔ Some will remain undissolved.

- Pour 5 mL of the room temperature saturated sugar solution into a small container and put it into an ice bath, a larger container with ice and a little water.
  ✔ Some of the sugar will come out of solution. Cold solutions almost always dissolve less of a solid than a warmer solution.

- Share and discuss their observations.

- Predict what will happen if they heat 5 mL of the original saturated solution.
  ✔ Some possible predictions are the sugar will come out of the solution, the solution will dissolve more sugar, and the solution will not dissolve more sugar.

- Test to see what occurs.
- Share and discuss their methods and results.

7. **Have the class summarize the effect of heat on a sugar solution.**

   Ask such questions as these:
   - Based on your observations of the sugar solution what seems to happen to the amount of a solid that can be dissolved as the temperature of the water is increased?
     ✔ The amount of solid dissolving increases as the temperature increases.

   - Based on your observations of the sugar solution what seems to happen to the amount of a solid that can be dissolved as the temperature of the water is decreased?
     ✔ The amount of solid dissolving decreases as the temperature decreases.

8. **Set up a Solubility Testing Center in the classroom. Have the students test materials with solvents other than water and record their observations on SP 3.10.6B SOLUBILITY TESTING.**

9. **Have the students develop working definitions for solution and dissolve. Record these in the Working Dictionary.**

EXTENSIONS

- Have the students hypothesize and investigate the bubbles in soda. (Carbon dioxide, CO_2, is the gas dissolved in the liquid.)
- Have the students devise their own questions and research them.

3.10.7 THINGS IN LIQUIDS

OBJECTIVES

The students
- Make a concept map about evaporation.
- Separate solids from liquids by evaporation.

BACKGROUND

This activity is the second in the series of four that deal with **dissolving, evaporation,** and **crystallization.** It builds on the ideas of solution and dissolving investigated in Activity 3.10.6 DISSOLVING THINGS and leads to Activities 3.10.8 CRYSTALS and 3.10.9 RAIN IN A JAR.

The students invent a way to recover solids from liquids. They have experienced evaporation outside by the sun and wind and slower evaporation inside by the air. These experiences should be included on their concept map about evaporation made in Procedure 1. To invent their method to recover the solid they will need to draw on this experience.

Next the students move on to discover that most of the liquids around them are solutions, one thing dissolved in another. Encourage the students to read labels. Many labels for drugs and household products have the name of the liquid in which other components are dissolved.

To make a saturated salt solution, add a quarter cup (70 mL) of salt to a quart (1 liter) of warm water. Stir or shake the contents until no more salt dissolves. If all the salt dissolves, add more salt. The solution is saturated when there is some leftover, undissolved salt. The amount that will dissolve varies with the temperature of the water or solvent. Sanitation practices should be followed since the students will be tasting materials.

STUDENT ROLE

Chemist

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MATERIALS

chart paper
markers
salt
small containers
toothpicks for stirring
graduated containers (See Activity 3.10.12 MEASURING DEVICES)
saturated salt solution
lids
cobalt chloride paper
common liquids students bring in to test.
Wonder and Discover Book
Student Pages 3.10.7A SALT IN WATER
3.10.7B THINGS IN LIQUIDS

PRODUCTS

Concept map about evaporation
Recovered salt crystals
Completed Student Pages

PROCEDURES

1. **Introduce the students to the activity by using the following experimental sequence.**

   Have them
   - Place a crystal of table salt on their tongue and report on how it tastes.
   - Dissolve about a milliliter (cm^3) of salt in a small amount (20 mL) of water, observing the process.
   - Taste a few drops of the salt water and report.

2. **Discuss the experiment with the class.**

   Ask such questions as these:
   - How did the salt crystal taste compared to the salt water?
     ✔ Work toward the idea that they taste the same but the taste of the salt crystal was more intense.
   - Where did the salt seem to go?

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- Could you see it going into the water?
- Can we get the salt out of the water? How?
- What do you think the salt would look like if the water were removed?

3. **Have the class make a concept map about evaporation.**

4. **Have student groups invent a way to remove the water from the salt solution. Discuss guidelines for their inventions.**

   Each group

   - Will each start with 2 mL of solution in a small container.
   - May work inside or outdoors.
   - May use any equipment in the Inventor's Box or classroom except artificial heat sources.
   - May take as much time as needed.
   - Will record their design and observations on SP 3.10.7A SALT IN WATER.
   - Will save any salt crystals collected for Activity 3.10.8 CRYSTALS.

5. **Have the groups report and discuss the results of their experiments.**

   Ask such questions as these:
   - How did you separate the salt from the water?
   - What do you think happened to the water?
   - Did anyone put their salt solution in a cool place? A warm place?
   - Did the water leave the solutions?

- Did the water leave the solution that was in a cool place as quickly as it did when the solution was placed in the sun or a warm part of the room?
  ✔ It is important to note that water does leave a thing even when it is cool. Clothes do dry when it is cool, just slower than when it is hot.

- What does the recovered salt look like?

- How do you know that you have recovered salt?

- What do you think is in coffee, milk, and liquid detergent?

- What do you think the liquid part of coffee, milk, and liquid detergent is?

- How could you test for water?
  ✔ Cobalt chloride paper can be used. It is blue when there is no water present and pink when there is.

- How could you find out whether something is dissolved in a liquid?

6. **Set up a class Liquid and Solids Separation Center.**

Have the students

- Test various liquids for a dissolved solid.
  ✔ Use coffee, tea, milk, soda, and other common liquids the students bring in.

- Test the liquid to see if it is water.
  ✔ Cobalt chloride paper can be used.

- Record the name of their substance to be tested, list the components found on its label, and describe the residue left after the liquid is removed on the class chart liquid and solid separation and SP 3.10.7B THINGS IN LIQUIDS.

- Periodically report on their findings.

7. **Have the students add new ideas to their concept map on evaporation.**

EXTENSION

- Have the students investigate their own questions. Record their questions in the Wonder and Discover Book.

3.10.8 CRYSTALS

OBJECTIVES

The students
- Study the growth of salt crystals.
- Apply techniques learned in growing salt crystals to the growing of sugar crystals.
- Study crystal growth from a melt in making nut brittle.
- Develop working definitions for evaporation and crystallization.

BACKGROUND

This activity is the third of a series of four dealing with **dissolving, evaporation, and crystallization.** It builds on the ideas developed in Activity 3.10.7 THINGS IN WATER. Activity 3.10.9 RAIN IN A JAR is introduced as a part of Procedure 2. This activity should be carried out when the humidity is low.

Students observe that crystals are produced when liquids evaporate from solutions and are helped to invent ways to grow salt crystals from a water solution. They use this experience to devise ways to grow sugar crystals. They also make nut brittle candy to observe how melted sugar crystallizes on cooling.

Instructions for making a saturated salt solution are found in Activity 3.10.7 THINGS IN LIQUIDS. If the solution added to the growing crystals is not fully saturated, the crystals will dissolve. This can be very frustrating for the students as they see all their hard work lost. To ensure that the liquid is fully saturated when preparing the saturated solution that will be used for feeding, always use a **solvent,** in this case water, that is warmer than the environment where the crystals will be grown. This saturated solution should always be cooled to the temperature of the solution around the crystals before it is added to the crystals. In the previous activity the students discovered that more of the **solute,** the substance dissolving, goes into solution when the temperature is higher than when it is lower. The recipes for Nut Brittle follow:

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RECIPE FOR CLEAR NUT BRITTLE

- Pour 250 mL (1 cup) of sugar into a sauce pan.
- Stir the sugar until it melts over low heat.
- Stir in 250 mL (1 cup) of nuts until all nuts are covered with the melted sugar.
- Pour the clear nut brittle onto a lightly oiled cookie sheet or foil.
- Break the brittle into pieces after it cools.

RECIPE FOR CARAMELIZED NUT BRITTLE

- Pour 250 mL (1 cup) of sugar into a sauce pan.
- Stir the sugar until it melts over low heat.
- Continue heating and stirring until the sugar turns light caramel brown.
- Stir in 250 mL (1 cup) of nuts until all nuts are covered with the melted sugar.
- Pour the caramel nut brittle onto a lightly oiled cookie sheet or foil.
- Break the brittle into pieces after it cools.

Since the students will be cooking and tasting, sanitation practices should be followed.

STUDENT ROLES

Chemist
Confectioner

MATERIALS

chart paper
markers
sugar
salt
water
peanuts, walnuts or other nuts
clean string
wood skewers or other supports for the crystal-growing string
clean jar lids
clean pint jars
spoons or eyedroppers
plastic wrap
hot plate, electric frying pan, or other heat source
cooking pot
concept map on evaporation, from Activity 3.10.7 THINGS IN LIQUIDS
Working Dictionary

Connections Book
cookie sheet or aluminum foil
measuring containers (See Activity 3.10.12 MEASURING DEVICES)
mixing spoon
cooking oil or spray
hot mitts (See Activity 3.10.13 SAFETY EQUIPMENT)
aprons (See Activity 3.10.13 SAFETY EQUIPMENT)
Student Pages 3.10.8A GROWING SALT CRYSTALS
3.10.8B GROWING SUGAR CRYSTALS

PRODUCTS

Class chart growing crystals
Salt and sugar crystals
Nut brittle
Working definitions for evaporation and crystallization
Completed Student Pages

PROCEDURES

1. **Have the students use a magnifying glass to observe the salt crystals they recovered in Activity 3.10.7 THINGS IN LIQUIDS. Have them compare these crystals with crystals of commercial table salt.**

   Ask such questions as these:
   - What are the shapes of the salt crystals formed when you evaporated water from the salt solution?
   - What are the shapes of the crystals of commercial table salt?
   - Which are larger?
   - How might you get crystals that are even larger?
     ✔ Work to the idea that they could feed a growing crystal more salt solution.

2. **Have student groups set up their salt crystallizing experiments.**

   Help the students
   - Make a saturated salt solution.
   - Label their lids.

- Place several of their largest and favorite-shaped seed crystals in a jar lid.

- Cover their crystals with the saturated solution.

- Place their lids in an environment where they think that the water will evaporate the fastest.
  ✔ Cover any lids that are placed outside with plastic wrap to keep out dust. **This provides the lead-in to Activity 3.10.9 RAIN IN A JAR as water droplets condense on the plastic wrap.**

- Discover that they need to let the water out of the lid.
  ✔ Have them put holes or slits in the plastic wrap.

- Repeat the feeding procedure several times and keep records on what they observe.
  ✔ It is best not to let the lid and contents get dry between feedings.

- Record their observations on SP 3.10.8A GROWING SALT CRYSTALS.

3. **Have the students discuss the observations and results of their experiments in growing salt crystals.**

Ask such questions as these:

- Who has the largest crystal?

- What did you do to get your crystal to grow so large?

- Who has a crystal that looks like the tiny commercial ones only larger?

- What did you do to get such a crystal?
  ✔ Work toward the idea that the shape of the original crystal provides a template for the later deposit of solute material.

- Who has a unusual looking crystal?

- Why do you think it took the shape that it did?
  ✔ Again get at the shape of the original crystal which provides a template for the later deposit of solute material.

- How could you speed up the rate of crystal growth.
  ✔ Work to the idea of speeding up the rate of evaporation by placing the lid in the sun or near a heat source.

- What are the steps in growing crystals? Create a class chart crystal growing that includes the sequence:

  1. Select a good crystal
  2. Feed the crystal a saturated solution containing the dissolved crystal material, and
  3. Evaporate away the liquid.

- How could you make sugar crystals?

4. **Have student groups invent ways to grow sugar crystals using their experience with salt crystals. Have them keep records of their experimental design and progress on SP 3.10.8B GROWING SUGAR CRYSTALS.**

5. **Discuss the observations and results of the students' experiments in growing sugar crystals.**

   Ask such questions as these:
   - Who has the largest sugar crystal?
   - What did you do to grow your crystal so large?
   - Who has a crystal that looks just like the tiny commercial ones only larger?
     ✔ Have the students look at commercial sugar crystals with a hand lens if they have not already done so.
   - What did you do to get such a crystal?
     ✔ Get at the idea of selecting a shape of the original or seed crystal that is like a commercial crystal.
   - Who has a unusual-looking crystal?
   - Why do you think it took the shape that it did?
   - How could you speed up the rate of crystal growth?
   - How is growing salt crystals like growing sugar crystals?
   - What did you do differently to grow sugar crystals?

6. **Have the class make nut brittle candy.**

7. **Have the students break the brittle into pieces and use magnifiers to look at the sugar crystals they have made from a melt. Discuss how some crystals such as synthetic rubies and sapphires are grown from melts.**

   Ask such questions as these:
   - What happened to the sugar as it got hot?
   - Did all of the sugar melt at the same time?
   - What did the melted sugar look like?
   - What happened to the sugar when it was poured onto the cookie sheet or foil?
   - What did it look like under the magnifying glass?
   - Was the brittle around the nuts the same as the brittle between the nuts?
   - Could you see candy crystals when the brittle was broken?
   - Did all of the brittle break the same way?
   - How was growing sugar crystals from a solution different from growing crystals from a melt?
   - How was growing sugar crystals from a solution similar to growing crystals from a melt?

8. **Have the students add to or revise ideas on their concept map about evaporation. Have them use their concept map to write working definitions for evaporation and crystallization. Record these in the Working Dictionary.**

9. **Have the students discuss dissolving, evaporation, and crystallization. Record their ideas in the Connections Book.**

   Ask such questions as these:
   - How are these processes connected to each other?
   - Where might these processes be used?
   - Who else needs to know about dissolving things? Evaporation? Crystallization?

EXTENSIONS

- Have the students make a display of crystals. Include some natural mineral crystals such as quartz.
- Have the students find out how other kinds of crystals can be grown.
- Encourage the students to attempt to grow other kinds of crystals from water-soluble substances that they bring in.
  ✓ Alum produces crystals easily.

3.10.9 RAIN IN A JAR

OBJECTIVES

The students
- Observe evaporation and condensation in a closed container.
- Hypothesize as to what the condensate is and test their hypotheses.
- Hypothesize as to how the condensate gets onto the condensing surface and test their hypotheses.
- Revise and add to their working definition of evaporation.

BACKGROUND

This Activity 3.10.9 RAIN IN A JAR is the last in the series dealing with solutions, evaporation, and crystallization. It is part of the long-term development of the connections between water, air, and rain. This activity leads to Activity 3.2.5 HUMIDITY.

This activity begins with Procedure 2 in Activity 3.10.8 CRYSTALS where the students place plastic wrap over the top of their crystals to protect them from dust. If the crystals are in the sun or near heat, droplets will collect on the plastic. When the students discover these droplets or when the teacher observes them, it is time to begin this activity. As an alternative plastic wrap can be used to cover the (warm) classroom stock of saturated salt or sugar solution to get the same result. Place a marble in the center of the covering to hold it down. This makes the condensation even more obvious.

Three questions are addressed in this activity. First, what could the droplets be? If the assumption is that they are water, this can be tested by smelling it, using cobalt chloride paper, seeing whether it dissolves salt and sugar, and so on.

The second question is how did the droplets get onto the plastic wrap? Cobalt chloride paper can be placed in the air between the plastic and the solution to see whether there is water in the air, a cold mirror can be placed in the air between the water and the plastic to see if water condenses on it, and so on.

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Third, do the droplets have the same content as the liquid around the crystals or in the bottom of the jar? The droplets can be dried to see whether they contain the same material as the solution. It is important that the plastic wrap over the jar or crystals be clean so that no solution gets into the drops. The drops should be only pure distilled water.

An answer to the first question may also provide the answer to the last question since the first question may be answered at a level that eliminates the possibility of the droplets being the solution. For example, the students could correctly say that the droplets are a liquid like water and then get a positive test for water using cobalt chloride paper.

The students devise experiments to answer each of the three questions. To save time the questions can be assigned to different groups of students. Be sure to allow the students enough time to come up with ideas and plan their experiments. These questions will take some time to consider. Building their own big-jar system may help them to get ideas.

To further the inquiry, substitute ice for the weight on the plastic wrap. This will accelerate the rate of condensation of moisture on the plastic wrap. Let the students explore this phenomenon without comment.

STUDENT ROLE

Physical chemist
Meteorologist

MATERIALS

large glass jars
plastic wrap
rubber bands
marbles, small stones, or weights to depress the plastic wrap
crystal-growing solutions from Activity 3.10.8 CRYSTALS
cobalt chloride paper
mirrors
ice
Concept map about evaporation from Activity 3.10.7 THINGS IN LIQUIDS
Working Dictionary
Connections Book
Student Page 3.10.9 DROPLET QUESTIONS

PRODUCTS

Big-jar system
Completed Student Pages

PROCEDURES

1. **Discuss the discovery of the droplets that collect on the plastic wrap covering the students' crystal experiments or the jar of saturated solution.**

   Ask such questions as these:
   - What could the droplets be?
   - What liquid do they look like?
   - How could you test your hypotheses?
   - What have you used to test for liquids in the past?
     ✔ Help the students to remember that they used cobalt chloride paper in grade one to test for water.
   - How could the droplets get onto the plastic wrap?
   - How could you test to see whether the liquid goes through the air?
   - Are the droplets the same liquid as the one in the solution around the crystals or in the bottom of the jar of saturated solution?
   - How could you test your hypotheses?
   - If the droplets were the same liquid as the solution around the crystals, what should happen if you let the droplets evaporate?

2. **Introduce the class to a large version of the crystal-growing system. See Figure 3.10.9.**

3. **Have student groups plan and set up experiments to answer their questions. Use SP 3.10.9 DROPLET QUESTIONS.**

4. **Have the groups discuss their observations and results.**

   Ask such questions as these:
   - What are the droplets made of?
   - What evidence do you have?
   - How did the water get onto the plastic wrap?
   - What evidence do you have?
   - Are there other places where you have seen water collect out of the air on surfaces as we found here? When?
     ✔ Work for examples such as fog on a car windshield, moisture on the mirror in the bathroom, moisture on a cold glass, dew on grass.
   - How might rain be like our jar?

5. **Have the students add to or revise their concept map and working definition of evaporation and record additional ideas in the Connections Book.**

EXTENSION

- Have the students devise their own questions about condensation and evaporation and research them.

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ILLUSTRATION

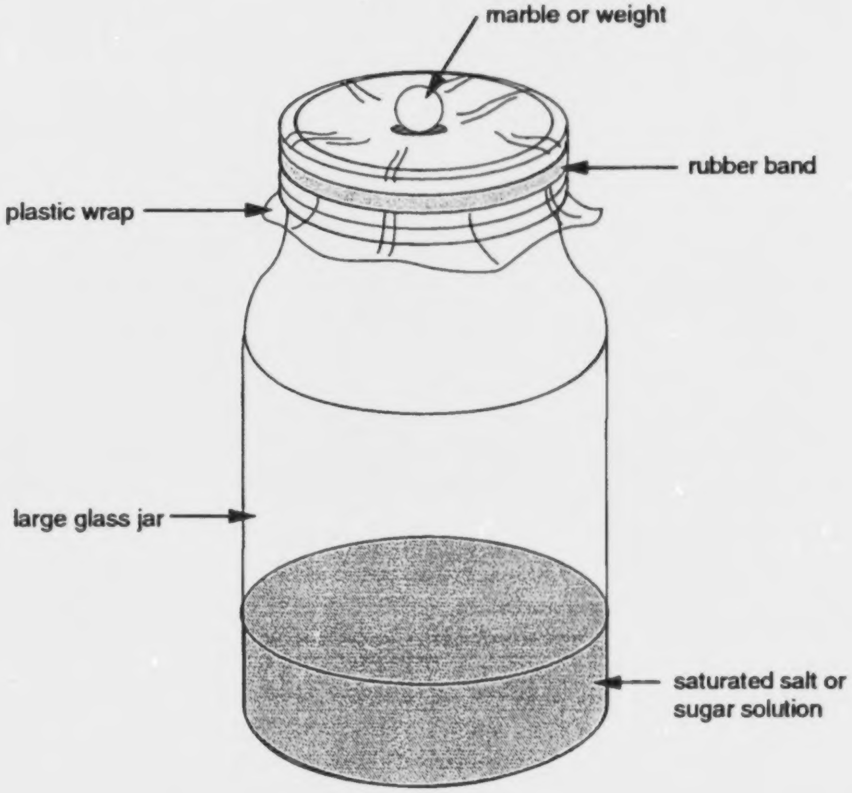
marble or weight
rubber band
plastic wrap
large glass jar
saturated salt or
sugar solution

Figure 3.10.9 Big-jar System

DASH 3.10.10 SUPERMARKET PLANNING

OBJECTIVES

The students

- Plan for the things needed to play the Supermarket Game.
- Estimate the space needed for each Group in the Supermarket Game.

BACKGROUND

This activity follows the introduction and discussion of Activity 3.5.9 SUPERMARKET GAME PREPARATION. The students organize the classroom space and plan things the six groups will need to construct before playing the game. The six groups are the Supermarket Group, the Consumer Group, the Food Processor Group, the Farm Group, the Bank Group, and the Newspaper Group. The entire class should be involved in planning for the supermarket equipment and for the sites and space required for all six groups. The groups should have their own communication and delivery systems where needed.

STUDENT ROLES

City planner
Architect

MATERIALS

meter-string cans
chart paper
markers
Student Page 3.10.10 SUPERMARKET PLANS

PRODUCTS

Supermarket plans
Completed Student Pages

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PROCEDURES

1. **Have the class discuss plans for constructing the things and organizing the classroom spaces needed to play the Supermarket Game.**

   Help them include such things as
   - Six spaces or areas to house the Supermarket, Food Processor, Farm, Newspaper, Bank, and Consumer Groups.
   - The need to accommodate 4–5 people at each site.
   - The need for communication systems between the work areas. See Activities 3.8.7 HELIOGRAPH, 3.8.8 SPEAKING TUBE, 3.8.9 STRING TELEPHONE, and 3.7.2 PROPELLER-DRIVEN MESSAGE CARRIER.
   - The need for delivery systems between the work areas. See Activity 3.7.4 DELIVERY SYSTEMS.

2. **Have the class make a list of the kinds of equipment needed for the Supermarket. Have them use Student Page 3.10.10 SUPERMARKET PLANS to record their ideas.**

   Help them include such things as
   - Shelving for canned and boxed foods.
   - Refrigerator cabinets for dairy and frozen foods.
   - Refrigerator cabinets for meats and fish.
   - Fruit and vegetable display areas.
   - Dry goods display areas.
   - Counter area.
   - Cart or basket storage.
   - Work space.
   - Cash registers.
   - Aisle space.
   - Communication and delivery systems.

3. **Have the students estimate the space needed for the supermarket equipment they will build, including space for the aisles. They need to consider that the supermarket must be able to accommodate the 4–5 students working in the market and the customers.**

4. **Have the students estimate the space needed for the six groups. Have them make lists of the equipment each group will need. See Activity 3.5.9 SUPERMARKET GAME PREPARATION. Have them use Student Page 3.10.10 SUPERMARKET PLANS to record their ideas.**

   Include such things as
   - Work space for 4–5 team members.
   - Communication systems.
   - Delivery systems.

5. **Have the class survey the classroom for space to construct the Supermarket and other work areas.**

6. **Discuss the requirements for the construction of the Supermarket and other game equipment with the class.**

   Include such things as
   - The kinds of materials that could be used.
   - The kinds of tools that might be needed.
   - The safe use and care of tools.
   - The need for stable buildings. Include such ideas as reinforcement, rigidity, and strength.
   - The kinds of attachment to the floor or walls that will be allowed.
   - The time allowed for construction.

7. **Have student groups make floor plans for the Supermarket and the other five work areas. Have them design a central construction site for tools and materials.**

EXTENSIONS

Have the students
- Draw floor plans to scale.
- Make a scale model of their supermarket plan.

3.10.11 SUPERMARKET CONSTRUCTION

OBJECTIVES

The students
- Review the safe use and care of tools.
- Design and construct the supermarket.
- Design and construct the equipment for the Supermarket Game.

BACKGROUND

This activity follows the introduction of and planning for the Supermarket Game in Activities 3.5.9 SUPERMARKET GAME PREPARATION and 3.10.10 SUPERMARKET PLANNING. The students use their plans and past construction experience to build the supermarket and the equipment to be used in the game.

The safe use and care of tools should be discussed. This is a good opportunity to review and apply the appropriate aphorisms from Activity 3.1.10 APHORISMS. Refer to Activities 3.7.2 PROPELLER-DRIVEN MESSAGE CARRIER, 3.7.4 DELIVERY SYSTEMS, 3.8.7 HELIOGRAPH, 3.8.8 SPEAKING TUBE, and 3.8.9 STRING TELEPHONE for construction of communication and delivery systems.

STUDENT ROLES

Safety engineer
Builder
Inventor

MATERIALS

cardboard
duct tape
paper
markers
paint
brushes
other materials as requested by the students

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serrated steak knives
heavy-duty scissors
other tools as requested by the students.
Student Page 3.10.11 CONSTRUCTION MATERIALS

PRODUCTS

Supermarket game equipment
Supermarket and other work sites
Completed Student Pages

PROCEDURES

1. **Have the students build the Supermarket and the game equipment needed using the plans made in Activity 3.10.10 SUPERMARKET PLANNING.**

   Have them
   - Make supply lists on Student Page 3.10.11 CONSTRUCTION MATERIALS.
   - Help collect and organize materials and supplies.
   - Construct the Supermarket and its equipment.
   - Set up the Supermarket.

2. **Have the students build the equipment needed for the farm, the food processing site, newspaper, bank, and the consumers' home site using their plans made in Activity 3.10.10 SUPERMARKET PLANNING.**

   Have them
   - Make supply lists using Student Page 3.10.11 CONSTRUCTION MATERIALS.
   - Help to collect and organize the materials and supplies.
   - Construct the equipment.
   - Set up the sites.

EXTENSION

- Have the students make scale drawings or models of their equipment.

3.10.12 MEASURING DEVICES

OBJECTIVES

The students
- Construct and calibrate meter-string cans.
- Make and calibrate volume jars.
- Build balances.
- Review the use of their measuring tools to find length, fluid volume, and mass.

BACKGROUND

In this activity the students remake and review the use of tools they constructed in earlier grades. Each tool is made when the need for it arises in another activity. If the students have had no previous experience with the tool, practice may be necessary before they become proficient in its use. The student pages can be used for this purpose.

The meter-string can is used to measure length. It is a 10- to 20-meter string, marked at each meter, that is wound around the outside of a coffee can for storage. Items needed in the field can be stored in the can. The strings are all standardized against each other. See the first grade Activity 1.10.1 METER-STRING CAN for more information.

The volume jar is a quart jar calibrated by the students to measure the volume of liquids and gases. The calibrations are compared against a class standard and are intended to provide only approximate measures. Calibrations are made in 100-milliliter increments. A liter and a quart are considered to be approximately equal at this grade level.

Five identical jars are required in the calibration process suggested here. Attach a piece of masking tape vertically on the side of the jar to be calibrated. Fill the jar with 1000 mL of water. Using a permanent marker, mark the top level as one liter. (There are 1000 mL in a liter.) Pour half the water into an identical jar so that the two jars contain equal amounts. Mark this level as 500 mL. Pour the 500 mL of water into five identical jars until all have equal amounts of water. Label this

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level 100 mL. Add water, 100 mL at a time, labeling each increment until the 1000-mL or one-liter level is reached. See the first grade activity 1.5.3 MEASURING VOLUME for further information.

When volumes smaller than 100 mL need to be measured as in Activity 3.10.3 ACID AND BASE REACTIONS, either of two calibration processes can be used. The first continues the process described above by dividing 100 mL of water into four identical containers. Then taking one 25 mL portion, this is divided into five identical containers using an eyedropper or a straw with a finger placed over one end. (Clear plastic 35-mm film containers work well. These hold 25–30 mL.) Once a 5-mL volume is identified, the container is calibrated into 5-mL increments by adding water in 5-mL portions.

The second way to calibrate a container into 5-mL increments is to use a pre-calibrated container such as a graduated cylinder. Have the students pour water into film cans, 5 mL at a time, marking the amount each time water is added. Students will learn to calibrate a container into 1-mL increments in grade four.

			Metric					English					
1	liter	=	1000	milliliters	=	approx.	1	quart*					
1/2	liter	=	500	milliliters	=	approx.	1/2	quart	=	1	pint		
1/4	liter	=	250	milliliters	=	approx.	1/4	quart	=	1/2	pint	=	1 cup
1/8	liter	=	125	milliliters	=	approx.	1/8	quart	=	1/4	pint	=	1/2 cup

* (1 liter = 1.057 quarts)

The balance is used to weigh things in mass units. Mass and weight are different properties of matter and are distinguished throughout DASH. MASS is the measure of the amount of matter in an object and is determined using a balance. The mass of an object is compared with a counterweight on a balance. The standard unit of mass is a gram (g). WEIGHT is the measure of the pull of gravity on an object and is found by using spring scales, grocery scales, or bathroom scales. Weight is measured in units of pounds (lb) or gram force (gF).

Both the process of mass measurement using a balance and weight measurement using a scale are called weighing. This is because the instruments used to make both measurements need gravity to operate. Mass does not change from place to place. On the balance, mass is measured by comparing the gravitational pull on a standard and an unknown. Weight, by contrast, is a measure of gravitational pull only on the object being weighed. The weight of an object is usually a measure of the amount a spring is extended or compressed by an object pulling or pushing on it. In the weaker gravity of the moon, an object would have less weight than it has on earth. In the stronger gravity of Jupiter the same object would have more weight than on earth. In all these different gravitational fields, the object's mass would remain the same. Figure 3.10.12 is a diagram of a typical student balance. See the second grade Activity 2.10.3 THE BALANCE for more information.

A measurement learning center can be set up to have the students practice using their measuring devices. Distances from one point to another can be measured with their meter-string cans. Finding the volume of assorted containers will provide practice with their volume jars. Various objects can be weighed using different units to build proficiency with their balances. Have the students record and compare their data on class charts to check for accuracy.

STUDENT ROLES

Engineer
Inventor

MATERIALS

chart paper
markers
meter-string cans:
    1 three-pound or smaller coffee can with plastic lid per group
    11–21 meters of string per group
    1 roll half-inch masking or plastic tape
    1 meter stick per group
    chalk
    1 washer per group
    1 waterproof marker per group
    Student Page 3.10.12A MEASURING LENGTH
volume jars:
    quart jars, 5–6 per group
    small glass jars, 4–5 per group
    clear plastic 35-mm film containers, 5 per group
    eyedroppers or straws
    half-inch masking tape
    1 waterproof marker per group
    water
    towels
    food color, optional
    Student Page 3.10.12B MEASURING VOLUME
balances:
    heavy-duty paper clamps (Bulldog)
    rulers

matched pairs of plastic containers
nail or ice pick
small paper clips, pennies, plastic beads, centigram cubes, nails, marbles, washers, shells, keys, etc. (small, nearly identical objects)
string
large paper clips
masking tape
Student Page 3.10.12C MEASURING MASS

PRODUCTS

Meter-string cans
Volume jars
Balances
Class chart of length
Class chart of volume
Class chart of mass
Completed Student Pages

PROCEDURES

1. **When the need to measure distance arises, work with student groups to construct meter-string cans.**

Have them

- Mark off the length of the classroom in meters. Use chalk to mark the meter points on the floor. Rooms are usually 8 or more meters in length. The string should be 10 to 20 meters long.
- Stretch a string up and back the length of the room.
- Mark each meter point along the string with a piece of tape.
- Number each meter on the tape with a waterproof pen.
- Attach the string to a large can by tying it to a washer through a hole in the can.
- Wind the string around the outside of the can for storage.
✔ The can may be used for equipment storage in the field.
- Place a rock in the can to anchor it so one person can make measurements.

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- Invent ways to measure 1/2 meter and 1/4 meter.
  ✔ Fold the string.

2. **Have the students standardize their measuring strings.**

   Ask such questions as these:
   - How long is your string compared to others?
   - Are the intervals between the meter points the same?
   - How many meters can you measure with your measuring string?
   - Is this number the same as others? Why?
   - Does any tape need to be renumbered? Which one? Why?
   - What advantage is there in using a large can to wind the string on?

3. **Set up a Measuring Center. Have the students use Student Page 3.10.12A MEASURING LENGTH to practice measuring with their meter–string cans. Have them record their data on the Class Chart LENGTH.**

   Ask such questions as these:
   - Are all our measurements of the same distance equal?
   - What could have happened to make them differ?
   - What could we do so they are more alike the next time?

4. **When the students need to measure the volume of a liquid in an activity, introduce the class standard volume jar. Have student groups calibrate their own jars.**

   Ask such questions as these:
   - How could we show the same volume in other jars?
   - How can we mark the jars so that we can always fill them to the same place?
   - How can we measure out one-half of this jar of water?
   - How can we mark the 1/2 liter of water so that we can use the jar over and over to get the same volume?

- How can we mark the 1/2 liter of water so that we can use the jar over and over to get the same volume?
- How many milliliters are there in one liter? In a half liter?
- How can we measure just 100 mL of water?
- How many jars would we need?
  ✓ Five
- How could we measure and mark 200 mL, 300 mL, 400 mL, etc., on the jar?

5. **Add volume activities to the Measuring Center. Have the students use Student Page 3.10.12B MEASURING VOLUME to record their measurements. Have them also record their data on the Class Chart VOLUME.**

   Ask such questions as these:
   - Are all our measurements of the same container equal?
   - Why might they differ?
   - What could we do so they might be more alike next time?

6. **Have the students compare their volume jars with the class standard and recalibrate as necessary.**

7. **When the need arises to weigh something, have student groups build balances.**

   Ask such questions as these:
   - How can you tell when two different objects have the same mass?
   - How does a balance work?
   - How do you know when there is the same amount of material on both sides of the balance?
   - What could we use as a counterweight?
     ✓ Centigram cubes, beads, paper clips, pennies, etc.

8. **Have the students weigh the same set of objects using various kinds of counterweights at the Measuring Center.**

Have them

- Weigh the same set of rocks, toy cars, etc., using pennies and paper clips as counterweights.
- Record their data on the Class Chart MASS.
- Discuss why the results of weighing might vary.

9. **Discuss the gram as the world's standard of mass.**

Have the students

- Measure how many paper clips are in 1 gram and in 10 grams.
- Measure how many pennies are in 10 grams and in 1 gram.
- Discuss whether pennies and paper clips weigh the same.
- Test their answers.

10. **Have the students improve their balances as necessary.**

ILLUSTRATION

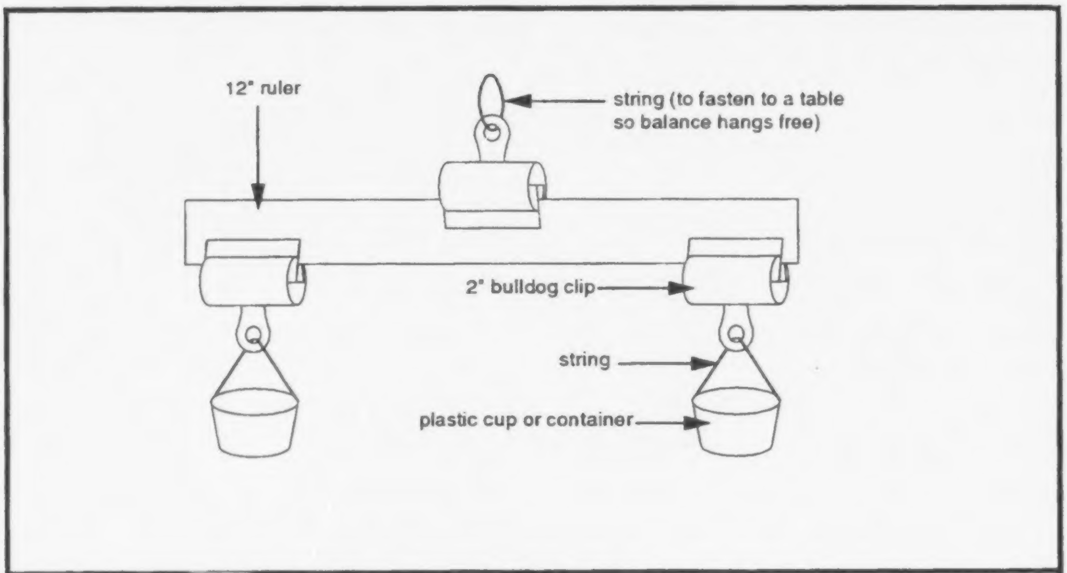
12" ruler
string (to fasten to a table so balance hangs free)
2" bulldog clip
string
plastic cup or container

Figure 3.10.12 Student Balance

3.10.13 SAFETY EQUIPMENT

OBJECTIVES

The students
- Discuss the need for classroom safety.
- Make plastic-bag raincoats.
- Invent protective aprons.
- Invent devices for handling hot objects.
- Make shields to protect their eyes from liquids.

BACKGROUND

Safety is a constant concern in DASH. To raise the level of awareness about things that are potentially dangerous the students make their own protective equipment. They are responsible for determining when such gear should be used and what its limitations are in protecting them. This of course does **not** take the primary responsibility for safety from the teacher, but it does provide many hands and eyes all trained to watch for safety hazards.

In this activity a safety team of two or more students is appointed each week to watch out for safety problems and alert the class when safety precautions should be taken.

DASH students have been making emergency raincoats from plastic bags since kindergarten. These can be made when a student does not have the proper covering to work in the rain. The students invent their own designs. Utility should be stressed. After use raincoats should be dried, folded, and stored for other emergency occasions.

Every student needs a plastic-bag apron for work in the classroom and field. The students again invent their own design. Utility is stressed. The aprons should be cleaned after use and stored.

Hot pads and other devices to handle hot materials are invented by the students. These also should be cleaned and stored after use.

Shields to protect eyes against liquids are introduced in grade three. Two designs for plastic-bottle eye shields are shown in Figure 3.10.13.

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The students should be given the latitude to invent any kind of shield as long as the eyes are fully protected. Procedure 6 lists the necessary safety features for the shield.

STUDENT ROLES

Safety officer
Inventor
Safety-conscious worker

MATERIALS

Responsibility chart
heavy-duty plastic bags, 20–30 gal
waterproof tape
cloth scraps
heavy-weight string
plastic containers, 1–2 gal (milk, bleach, etc.)
heavy, clear plastic for eye shield window (clear plastic bottles, overhead masters, etc.)
duct tape
soft foam rubber or sponge
rubber bands
scissors
razor blade or sharp knife for the initial cut in plastic (Teacher use only.)
Connections Book
Student Page 3.10.13 SAFETY EQUIPMENT

PRODUCTS

Concept map about classroom safety hazards
Class list of classroom safety rules
Raincoats
Aprons
Devices to handle hot materials
Eye shields
Completed Student Pages

PROCEDURES

1. **Have the class develop a Concept Map about classroom safety hazards.**

Help them include such ideas as

- Slippery floors.
- Hot things.
- Things that can get into eyes.
- Things that can be tripped over.
- Sharp and pointed things in desks.
- The way equipment is used.
- Misuse of sharp tools.
- Things that can fall over.
- Wet clothes.
- Clogged drains.
- Clutter.
- Blocked exits.

2. **Introduce and discuss the need for a safety team to remind the class about safety rules.**

Have the students

- Use their Concept Map to develop a list of Class Safety Rules.
- Add the safety team to their RESPONSIBILITY CHART.
- Write a job description for the safety team.
- Listen to the safety teams report on what they have done during the first weeks on the job.
- Revise the job description as necessary.

3. **When an activity requires covering clothes, have the students invent aprons. Use the Inventor's Box.**

Ask such questions as these:

- What materials can protective aprons be made out of?
  ✔ Work for agreement on the use of plastic.

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- What should be done with the aprons after they've been used?
  ✔ Work to the idea of cleaning and storing them for later use.

4. **When an activity calls for going outside in the rain, have the students who have no raincoats invent one. Use the Inventor's Box.**

   Ask such questions as these:
   - What can raincoats be made out of?
     ✔ Work for agreement on large plastic bags.
   - What precautions do we need to take when we put a plastic bag over our heads?
     ✔ Get at the need for air holes.
   - What should be done with our raincoats after we use them?
     ✔ Work to the idea of drying and storing them for later use.

5. **When an activity requires students to handle hot materials, have them invent hot pads or other devices. Use the Inventor's Box.**

   Ask such questions as these:
   - What materials could be used to invent devices to handle hot things?
     ✔ Work toward the idea that the materials should not be destroyed at the temperature of the item being handled. Cloth or wood can be used at lower temperatures. At higher temperatures metal or ceramic materials should be used.
   - What should be done with the holders after they have been used?
     ✔ Work to agreement on cleaning and storing them for later use.

6. **When an activity requires the students to handle liquids that might get into their eyes, have them make eye safety shields. Show them a model but leave room for the invention of comfort modifications. Discuss the safety features required.**

   Have the students test their shields before use for the following safety features:

   - The plastic window should be wide and broad enough to look in all directions.
   - The plastic window should not allow liquid to come in directly or around the sides.

- The shield should not slip off of the head.
  ✔ Rubber bands and foam rubber can be used to secure the shield.
- The lid should be left on the spout to completely enclose the top of the head if the upright model is used.
- Shields should be cleaned, inspected, and stored after use.

7. **Have the students discuss and extend their ideas about safety hazards and equipment. Record their ideas in the CONNECTIONS BOOK.**

   Ask such questions as these:
   - Who else needs to know about safety hazards? Why?
   - Where else might our CLASSROOM SAFETY RULES apply?
   - Where else might you need to invent safety equipment?

EXTENSION

- Have students design other safety equipment such as foot coverings and storage systems as needed.

ILLUSTRATIONS

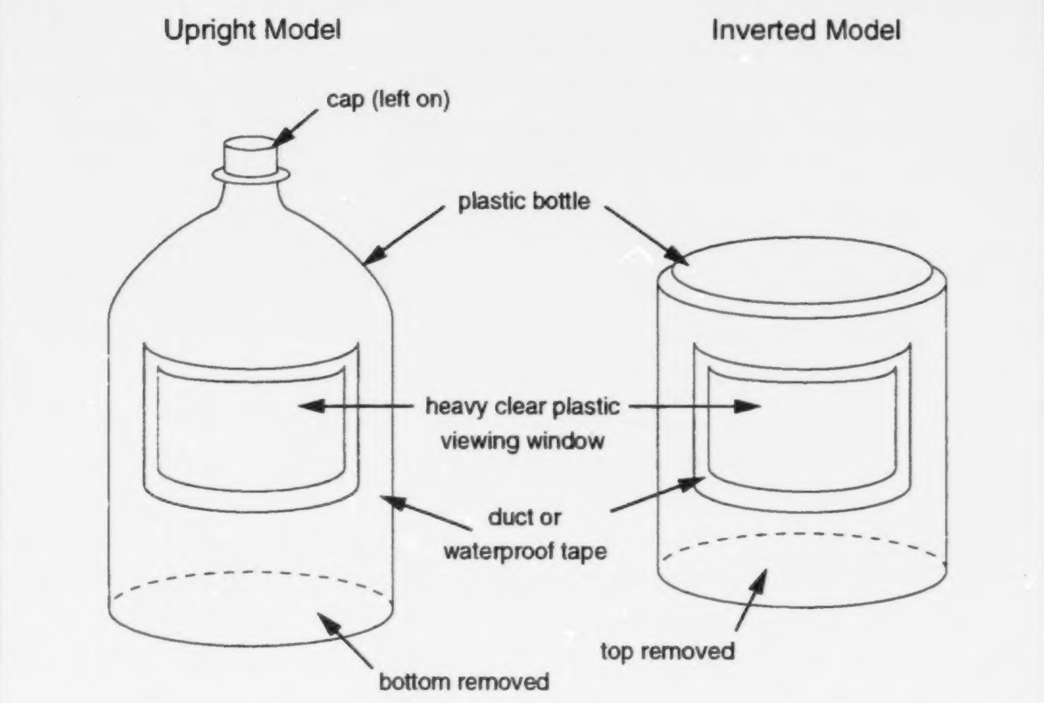
Upright Model
Inverted Model
cap (left on)
plastic bottle
heavy clear plastic viewing window
duct or waterproof tape
bottom removed
top removed

Figure 3.10.13 Eye Shields

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DASH

ACIDIC AND BASIC SOIL
SP 3.10.1

Name: ____________________

Date: ____________________

SAMPLE	pH	COLOR	ACIDIC OR BASIC
Tap water			
Acid solution			
Base solution			
Garden soil			

Describe how you measured pH.

DASH

ACIDS AND BASES
SP 3.10.2

Name: ______________________

Date: ______________________

pH SCALE													
1	2	3	4	5	6	7	8	9	10	11	12	13	14

TESTING FOR ACIDS AND BASES

SUBSTANCE TESTED	pH	ACID or BASE?

DASH

ACID AND BASE REACTIONS
SP 3.10.3

Name: ____________________

Date: ____________________

ACID REACTIONS			
TEST MATERIAL	TIME	OBSERVATIONS	pH
BASE REACTIONS			
TEST MATERIAL	TIME	OBSERVATIONS	pH

SP 3.10.4

DILUTING ACIDS AND BASES
SP 3.10.4

Name: ____________________

Date: ____________________

Syrup + no water = __________ taste

Syrup + __________ water = just right taste

Syrup + water + more syrup = __________ taste

ACID	pH	ACID ADDED TO SODIUM BICARBONATE		BASE	pH
		PREDICTIONS	OBSERVATIONS		
Jar #1				Jar #1	
Jar #2				Jar #2	
Jar #3				Jar #3	
Jar #4				Jar #4	

1. How do you dilute a drink syrup, acid, or base solution?

2. How do you concentrate a drink syrup, acid, or base solution?

3. What happens to the pH of an acid as you dilute it?

4. What happens to the pH of a base as you dilute it?

5. What does pH seem to measure?

6. Describe how you could measure the concentration of an acid using sodium bicarbonate.

DASH

ACID-BASE INTERACTION
SP 3.10.5

Name: ______________________

Date: ______________________

Record your prediction.

Describe what you will do to test your prediction.

Record your observations and results.

SP 3.10.6A

DASH

DISSOLVING THINGS
SP 3.10.6A

Name: ______________________

Date: ______________________

Problem 1: Dissolving Liquids in Water

LIQUID	AMOUNT	AMOUNT DISSOLVED			OBSERVATIONS
		ALL	SOME	NONE	

Problem 2: Dissolving Solids in Water

SOLID	AMOUNT	AMOUNT DISSOLVED			OBSERVATIONS
		ALL	SOME	NONE	

Problem 3: Dissolving Sugar in Water at Different Temperatures

°C	AMOUNT OF SUGAR DISSOLVED	OBSERVATIONS

DASH

SOLUBILITY TESTING
SP 3.10.6B

Name: ____________________

Date: ____________________

LIQUID (SOLVENT)	AMOUNT	MATERIALS TO BE DISSOLVED	AMOUNT	AMOUNT DISSOLVED			OTHER OBSERVATIONS
				ALL	SOME	NONE	

DASH

SALT IN WATER
SP 3.10.7A

Name: ______________________

Date: ______________________

Draw and label your design for separating the salt from the water. Describe any changes you made to your design.

Describe what happened and your results.

DASH

THINGS IN LIQUIDS SP 3.10.7B

Name: ______________________

Date: ______________________

NAME OF LIQUID	CONTENTS LISTED ON LABEL	WATER TEST		DESCRIPTION OF RESIDUE
		YES	NO	

SP 3.10.8A

DASH

GROWING SALT CRYSTALS
SP 3.10.8A

Name: ______________________

Date: ______________________

Draw and label your device for growing salt crystals.

DATE	OBSERVATIONS

DASH

GROWING SUGAR CRYSTALS
SP 3.10.8B

Name: ____________________

Date: ____________________

Draw and label your device for growing sugar crystals.

DATE	OBSERVATIONS

DASH

DROPLET QUESTIONS SP 3.10.9

Name: ______________________

Date: ______________________

What do you think the droplets are?
Describe your experiment and your results.

How could the droplets get onto the plastic wrap?
Describe your experiment and your results.

Are the droplets the same liquid as the solution covering your crystals?
Describe your experiment and your results.

DASH

SUPERMARKET PLANS
SP 3.10.10

Name: ____________________

Date: ____________________

AREA	EQUIPMENT NEEDED	SPACE NEEDED AND LOCATION
SUPERMARKET		
FARM		
FOOD PROCESSING AREA		
BANK		
NEWSPAPER		
CONSUMER AREA		

CONSTRUCTION MATERIALS
SP 3.10.11

Name: ______________________

Date: ______________________

EQUIPMENT TO BE CONSTRUCTED	MATERIALS NEEDED	WHERE TO GET MATERIALS	TOOLS NEEDED

DASH

MEASURING LENGTH
SP 3.10.12A

Name: ______________________

Date: ______________________

FROM WHERE?	TO WHERE?	HOW MANY METERS?

DASH

MEASURING VOLUME SP 3.10.12B

Name: ______________________

Date: ______________________

CONTAINER	VOLUME (mL)	CONTAINER	VOLUME (mL)

DASH

MEASURING MASS SP 3.10.12C

Name: ______________________

Date: ______________________

OBJECT WEIGHED	NUMBER OF UNITS	MASS UNIT

DASH

SAFETY EQUIPMENT
SP 3.10.13

Name: ______________________

Date: ______________________

Draw and label your design for a shield to protect your eyes from liquids.

Describe how your shield protects your eyes.

DASH

GRADE 3

SUPPORT MATERIALS

Grade 3

Start-Up Activities

DASH

Developmental Approaches in Science, Health and Technology

Curriculum Research & Development Group
University of Hawai‘i

DASH

GRADE 3

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SU.1 CLASSIFICATION

OBJECTIVES

The students
- Use their senses to describe selected objects.
- Identify the different senses used in collecting the information.
- Relate physical properties of things to senses.
- Classify a collection of items according to their similarities and differences.
- Are introduced to two category classification or dichotomous classification.
- Classify objects by their physical properties.
- Identify both similarities and differences in functions of items.
- Classify items by their functions.

BACKGROUND

This start-up activity is designed to introduce students new to DASH to the fundamental science concept and skill of classification. The teacher will need to adapt and modify the suggested procedures depending on the previous experience and developmental level of the students.

Senses and properties

The students first make a concept map about the senses of sight, hearing, touch, smell, and taste. They associate these senses with their sensing organs—eyes, ears, skin, nose, and tongue and identify the properties of objects that can be sensed—color, sound, texture, temperature, odor, flavor, and so forth.

Same and Different game

The students next play the Same and Different game in which they sort items into six or more different major categories. Each major category is made up of some set of common classroom items such as paper clips, books, pencils and so forth. Objects in a category have the same form and function. The *form* of an object refers to its physical properties, what it is made of, and its parts and their organization. The *function* of an objects refers to what it does or is used for.

Kinds of things or categories

The teacher and students work together to create category names such as pencils, rulers, paper clips and so forth as two or three different kinds of things or items are drawn from a container holding a Master Collection.

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The students then match other items with existing categories or create new categories when different kinds of items are presented. The students can also invent logos to represent each category—example, a picture of a pencil or a ruler.

Building a Master Collection

Most of the procedures in this activity use a master collection of items. It needs to be large enough so there is at least one item per student. Needed for the master collection are 6 or more major categories, each with two subcategories. One of the two subcategories has items that all look the *same*. The other subcategory has the same kind of items but they look *different* from all other items. For example, the major category pencils could have a *same* pencils subcategory—two brand new white pencils and a *different* pencils subcategory —four to eight used, different colored pencils. See Figure SU.1(1) for some suggestions for a master collection.

Category: Pencils Subcategories: 2 New pencils that look the same. 4-8 Used pencils, each different from all other pencils. (e.g. different colors, lengths)	Category: Paper Clips Subcategories: 2 New paper clips that look the same. 4-8 Paper clips, each different from all other paper clips (e.g. different colors, sizes)
Category: Books Subcategories: 2 New books that have the same title. 4-8 Used books, each with a different title.	Category: Rulers Subcategories: 2 New rulers that look the same. 4-8 Used rulers, each different from all other rulers (e.g.. different colors, materials)
Category: Paper Subcategories: 2 New sheets of paper that look the same. 4-8 Used sheets of paper, each different from all other sheets of paper. (e.g. different colors, sizes)	Category: Crayons Subcategories: 2 New crayons that look the same and have the same color. 4-8 Used crayons, each different from all other crayons. (e.g. different colors, lengths)

Figure SU.1(1) Six possible categories of game items for a master collection.

Physical properties and two category classification

Next the students use the physical properties of size, shape, and other visual and tactical characteristics to separate items into subcategories. To do this they are first introduced to a two category or dichotomous system for sorting or classifying items. Scientists use a simple two category or dichotomous system to sort or classify things. They take a collection of items, inspect it, and divide the collection into two different categories. One category has a distinct characteristic and the other does not have that characteristic.

Name Game

To get a feeling for the dichotomous classification system, start with the Name Game. Select four or five students and group them in the inclusive category *All Students*. For example, *All Students* might be Jan, Jack, Jill, Jo, and Jim. Then divide *All Students* into two categories—*Jan* and *Not Jan*. Next divide *Not Jan* into two more categories—*Jill* and *Not Jill*. Continue the process until *Jo, Jack* and *Jim* have their own separate categories. See Fig. SU.1(2).

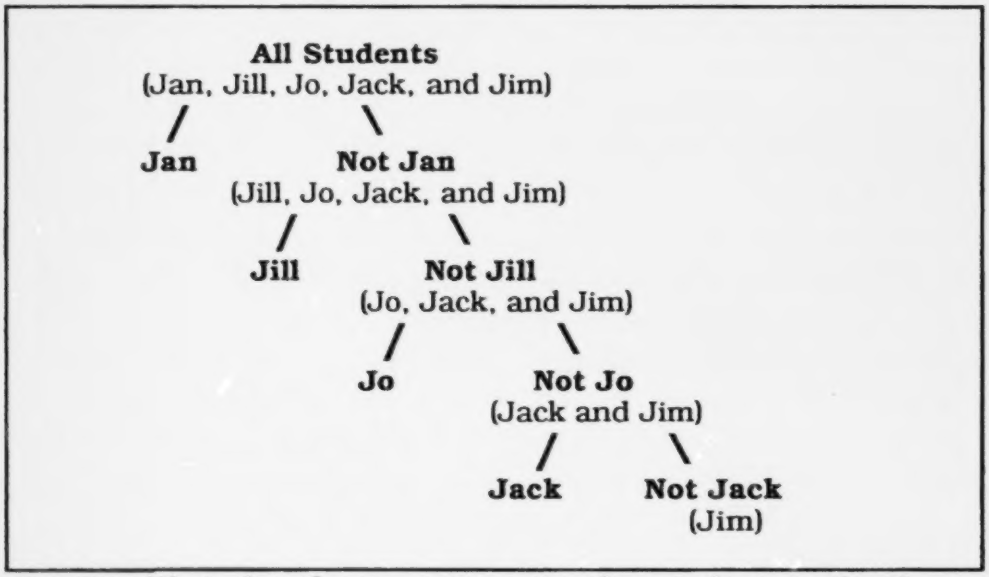

Fig. SU.1(2) A classification tree sorting five students in the Name Game using a two category or dichotomous system.

Classification game

Use the items from the Master Collection for the classification game. Have the students classify the objects by their physical properties or *forms*. First the students work with the teacher on one of the major categories such as pencils. Together they successively divide the items in the major category into pairs of sub-categories using differentiating physical properties. After the students have worked through classification of one major category, have them work in small groups to classify other major categories.

Follow the process used in the Name Game. On a table or the floor put all of the items in a single major category. *All pencils* are shown in the example in Fig. SU.1(3). The first two subcategories of *All Pencils* are

White pencils and *Not white pencils*. Then the *Not white pencils* are divided into two subcategories—*Yellow pencils* and *Not yellow pencils*. Again the division continues until the items can no longer be separated. Here the pencils were separated by the physical property of color. Multiple physical properties such as color and length, can be used within the same category classification as desired.

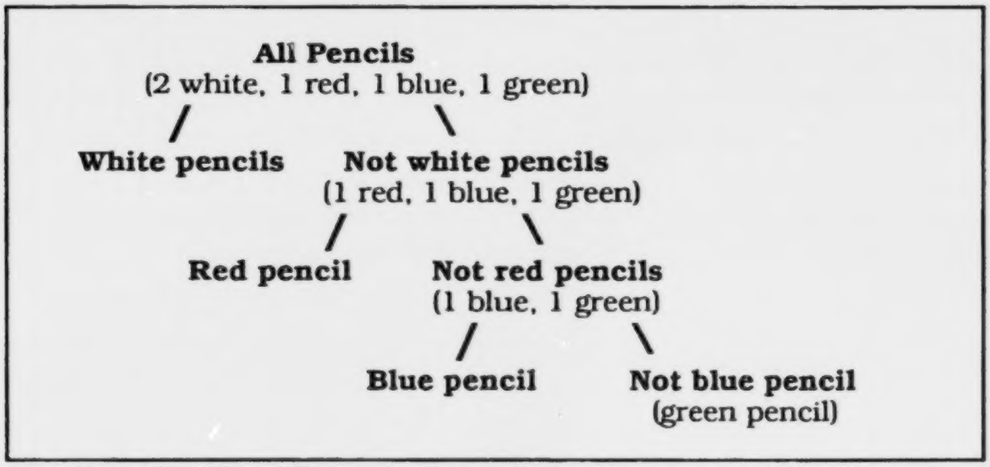

Fig. SU.1(3) Classification of pencils using a two category or dichotomous system and a classification tree.

Showing steps in the classification
The students are then asked to help draw a diagram showing the steps they went through to identify different objects as in Figures. SU.1(1–2). This creates a *classification tree* by connecting the words or boxes with lines to show the division of categories. The students record their categorization on a class chart. Then they work in small groups to classify other major categories and record their work on SP SU.1 CLASSIFICATION TREE.

Function classification game
Next the students are introduced to classification by *function*. First they work with the teacher to classify items and to get an idea of the meaning of the function of a thing or what it does or is used for. Then they work in small groups to classify sets of items by function.

Function game
The function game is played with one item from each of four of the major categories from the master collection. These are put on the table and the students find a functional category name that will fit them all. For example, for a collection of a pencil, ruler, crayons, and a piece of paper, the functional category could be *Things used in drawing* or *Classroom tools*. The students then classify the set into a pair of function subcategories labeling the function of one item and labeling the other as not having that function. For example; *Thing used in measuring* (ruler)

and *Things not used in measuring* (all other items). Words or logos are used to identify the function categories. Figure SU.1(4) shows some possible functions for items in the master collection. With the teacher, the students separate the remaining three items into functional subcategories. For example: *Things used to write on* (paper) and *Things not used to write on* (crayons and pencils). See Figure SU.1(5).

Item	**Possible Function**
Book	Items used to read, to hold printed words and pictures, to press flowers, etc.
Crayon	Items used to color paper, to batik, to color candles, etc.
Paper	Items used to write on, to make airplanes or spitballs, etc.
Paper clip	Items used to hold papers together, to release computer disks, etc.
Pencil	Items used to write on paper, to poke holes, to hold doors open, etc.
Ruler	Items used to measure distance, to draw straight lines, to make ramps for marbles, etc.

Figure SU.1(4) A list of some possible functions for the master collection.

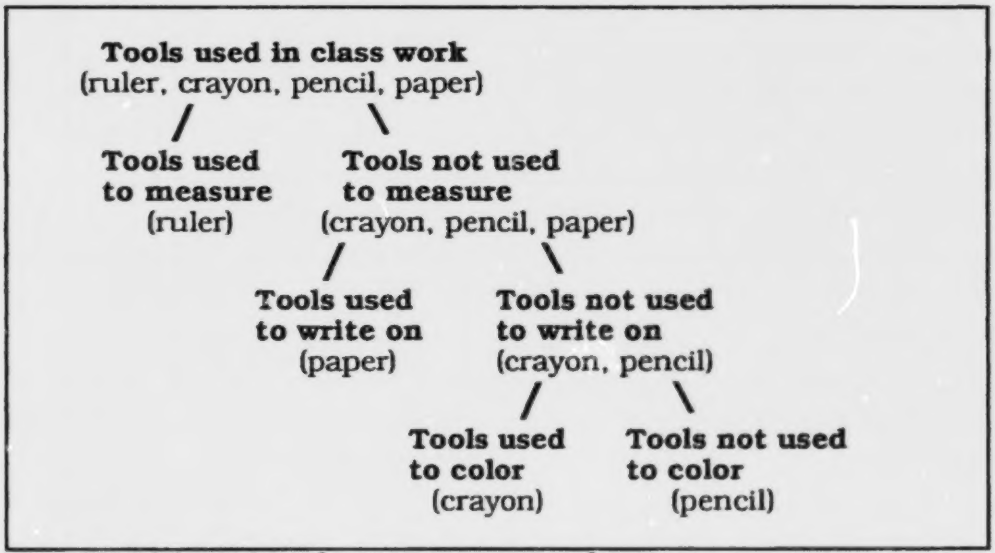
Tools used in class work
(ruler, crayon, pencil, paper)
Tools used to measure
(ruler)
Tools not used to measure
(crayon, pencil, paper)
Tools used to write on
(paper)
Tools not used to write on
(crayon, pencil)
Tools used to color
(crayon)
Tools not used to color
(pencil)

Fig. SU.1(5) A classification tree using function.

STUDENT ROLES

Observer
Classifier
Taxonomist

MATERIALS

chart paper
markers
items for the master collection
Student Page SU.1 CLASSIFICATION TREE

PRODUCTS

Class charts of classification using form and function
Completed Student Pages

PROCEDURES

1. **Have the students construct a concept map about physical properties and the senses.**

   Help them to include such ideas as these by asking questions about

- The sense of sight.
  ✔ Work to the idea that the eyes provide the sense of sight.
  ✔ Include sight associated physical properties such as color, size, shape, pattern and so forth.

- The sense of hearing.
  ✔ Work to the idea that you hear things with your ears.
  ✔ Include hearing associated physical properties such as pitch (high/low), intensity or amount (soft/loud/painful), beat (fast/slow), and so forth.

- The sense of touch.
  ✔ Work to the idea that you feel things with the skin.
  ✔ Include touch associated physical properties such as feeling texture (rough/smooth, soft/hard, sharp/dull, others), pressure (heavy/light/pain), temperature (hot/cold), and so forth.

- The sense of smell.
  ✔ Work to the idea that you smell things with the nose.
  ✔ Smells are described as being like something known–like fruit, perfume, or foul odors.

- The sense of taste.
  ✔ Work to the idea that you taste things with the tongue.
  ✔ Include touch associated physical properties such as sweet, sour, bitter, and salty.
  ✔ CAUTION: Remind students that it is dangerous to taste things that are not foods.

2. **Introduce the Same and Different game using items from the master collection. See Background. Keep items in a container so that they are seen only when pulled out. Have the students focus on the major category names (pencils, paper clips, paper, and so forth). Do not worry about subcategory differences at this time.**

   - Pull an item from the container and ask the students to give it a name.
     ✔ Ask, What is this? or what do we call this? The name they suggest will usually tell what kind of thing the item is and be its category name.

   - Draw a box or circle on chart paper and put the item in it. Label the box with the category name.

   - Show the students another item and ask them if it is the same or different from the one already out in the circle or box.

- If different, draw and place it in a different box or circle. Label the box with the new category name.
  ✔ Start using the term *category* to describe the box or circle and the items in it.

- If it is the same, place it in the box with the similar object.
  ✔ Start using the term *category* to describe the box or circle and the items in it.

- Ask why they put the item where they did?
  ✔ Usually students will say they look alike or do the same things.

- Ask why they didn't put the items in some other category?

- Continue until the students are reasonably fluent with the ideas of same, different, and category.

- Summarize the activity by asking what they mean when they say something is in a *category*. Ask them to give examples of categories and things that could be included in them.
  ✔ Work to such things as new, old, and used pencils are in the category pencils; new, old, and beat-up cars are all in the category cars. In each case members of the category share some properties and do the same thing.

- Help the students to understand the importance of knowing about physical properties by asking them how they tell one object from another.
  ✔ Work to describing the physical properties of the objects.

3. Introduce the students to playing a Name Game.

- Draw a large circle on chart paper and give it the name *All Students*. See Fig SU.1(2).
  ✔ Ask for volunteers and select 4.
  ✔ Have the 4 students write their initials in the circle.
  ✔ Announce that this is the *All Students* circle and label it.

- Draw another circle outside the big circle. Put the initials of Student #1 in the circle.
  ✔ Announce this is *Student #1's* circle. Label it.
  ✔ Ask if the big circle still has the correct name now that Student #1 is not in it.
  ✔ Work to the idea that they need a new circle that does *not* include Student #1.

- Draw a *Not Student #1* circle at the side of the *Student #1* circle. See Fig SU.1(2). Have the remaining students put their initials in the new circle. Ask what a name for the circle might be.
  ✔ Work to the response the *Not Student #1* circle. Label it.

- Draw another circle below the *Not Student #1* circle. Put the initials of Student #2 in the circle.
  ✔ Announce this is *Student #2's* circle. Label it.
  ✔ Ask if the *Not Student #1* circle still has the right initials now that Student #2 is not in it.
  ✔ Work to the idea they need a new circle that does *not* include Student #2.

- Draw a *Not Student #2* circle at the side of the *Student #2* circle. See Figure SU.1(2). Have the remaining workers put their initials in the new circle. Then ask the students to name the circle and label it.
  ✔ Work to the response the *Not Student #2* circle.

- Draw another circle below the *Not Student #2* circle. Put the initials of Student #3 in the circle.
  ✔ Announce this is *Student #3's* circle.
  ✔ Ask if the *Not Student #2* circle still has the right name now that Student #3 is not in it.
  ✔ Work to the idea they need a new circle that does *not* include *Student #3.*

- Draw a *Not Student #3* circle at the side of the *Student #3* circle. See Figure SU.1(2). Have the remaining student put initials in the new circle.
  ✔ Ask if is it fair to call this circle *Not Student #3* since all other students have their own circle.
  ✔ Work to the response that since only *Student #4* is in the circle it could also be called *Student #4's* circle.

- Help the students add connecting lines to the chart to show how the classification of students was accomplished. Introduce the term *classification tree* for this type of chart.

- Ask the students to tell what they think a classification tree can tell them.
  ✔ Work to the idea that it shows how you think as you make selections of things or people.

4. **Use the items from one of the major categories in the Master Collection and introduce the Classification Game. See Figure SU.1(3) for an example with pencils. Place all items on a piece of chart paper on a table or the floor and go through their classification with the students.**

Ask such questions as these:

- What is the name of the category?
  ✔ Write the name of the category in a box or circle containing all items.

- Can you divide these things into two categories so that things in one category will have a property and all the things in the other category will not have that property?
  ✔ Draw boxes or circle around the subcategories and help the students identify them with labels.
  ✔ The same name or logo is used for pairs of categories. Run a diagonal line through the *not* logo.
  ✔ Continue the subdivision and labeling as far as possible.
  ✔ Post the drawing showing the steps in subdivision.

- What did you use to separate one category of things from another?
  ✔ Work to the idea of using different properties of items.

- What kinds of properties did you use?
  ✔ Get at such things as differences in shape, color, materials, weight, size, and others.
  ✔ Give these things the names *physical properties* and *form.*

- How is this classification similar to the Name Game?
  ✔ Get at the idea that they are the same only one used people and the other objects.

5. **Organize the class into teams of 4–5 students. Give each team one of the major categories of things from the master collection. Have them classify the items, recording the steps and categories on a classification tree using Student Page SU.1 CLASSIFICATION TREE.**

Have the students

- Divide their major categories into two subcategories so that things in one subcategory have a property and things in the other category do not have the property.

- Draw boxes, connecting lines to show steps, and create identifying names or logos.

- Continue the subdivision as far as possible.

- Exchange classification sets and repeat the process.

6. **Use the master collection of items and introduce the Function Game to the class. Put four items from four different major**

categories on chart paper on a table or the floor. See Figure SU.1(5).

Ask such questions as these:

- What do you use these things for?
  ✔ Get at such things as using them as classroom tools, using them to do work at school, or using them as tools in an office.

- Does anyone know a word for the *uses of things*?
  ✔ Get students suggestions and home in on *function.*
  ✔ Draw a box or circle around the items and label the collective function category.

- Can you divide these things into two categories so that things in one category have a special function and things in the other category do not have that function?
  ✔ Discuss possible divisions. If the students do not come up with an idea suggest one yourself. See Figure SU.1(4).
  ✔ Draw boxes or circles around the subcategories and help the students identify them with function names.
  ✔ Continue the subdivision as far as possible.

- Can someone draw lines to show the steps used in the classification?
  ✔ Help the volunteer draw lines between the boxes or circles.
  ✔ Post the chart showing the steps in subdivision using function.

7. **Organize the class into teams of 4–5 students. Give each team four to six items from the different groups and a sheet of paper or Student page SU.1 on which to draw their classification steps or tree. Have them play the Function Game.**

   - Help them give their total collection a category name based on function.
     ✔ It can be the same as the one used in the introduction.

   - Help the students divide their categories into two subcategories so that things in one subcategory have a function and things in the other category do not have that function.

   - Help them draw boxes or circles, connect lines to show steps, and create identifying names as needed.

   - Help the students continue the subdivision until each item has its own functional subcategory.

   - Summarize the game.

✔ Ask if they have seen other trees like the one from the Function Game. Bring out the Name Game and physical properties classification trees.

✔ Ask how the trees are alike. Get at the idea that they are all used to sort and classify.

✔ Ask them what is meant by *category. Form. Function.*

- Summarize the importance of knowing about form and function.

  ✔ Ask the students how they use function in making their selection of items needed to go back to school. Work for selecting items to write with such as pens and pencils, things to write on such as paper and notebooks, and so forth.

  ✔ Ask the students how they use form in making their selection of items needed to go back to school. Work for selecting colors of pens, shapes of erasers, sizes of paper, and so forth.

DASH

CLASSIFICATION
TREE
SP SU.1

Name ____________________

Date ____________________

SU.2 WORKING DEFINITIONS

OBJECTIVES

The students
- Review the components of a working definition—form, function, and category.
- Practice making working definitions.
- Start to compile a working dictionary.

BACKGROUND

In this start up activity students new to DASH review the concepts of form, function and category introduced in Activity SU.1 CLASSIFICATION. They then use these ideas to identify the components in working definitions and to write some of their own.

Working definitions

Scientific progress relies on *working definitions* or operational definitions which describe the current understanding of a concept or term. These definitions are called *working* because they allow the work of science to go on, understanding that the definition may be changed or modified in the future.

Students' definitions

Research on children's development of definition indicates that the ideas they have about the world are constantly changed or modified by experience. DASH has called on these findings for guidance and therefore uses working definitions to support the students' continual shaping and reshaping of concepts and ideas.

A record of working definitions gives the students a way to keep track of their evolving thinking and learning. Working definitions provide teachers a window into the student's or the class's grasp of ideas. There should be a review of previous definitions whenever an already-defined concept re-emerges. When reviewed, a definition can be added to or changed.

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Focus Book
If available from a DASH kindergarten teacher, the Focus Book, *THE FRIENDLY SHAPE*, can be used with younger students to help them get a sense of working definitions. See Activity K.1.10 WORKING DICTIONARY AND WORKING DEFINITIONS in the *DASH Kindergarten Teacher Guide* for suggestions on using this book.

Evolving definitions
Beginning working definition may include only a category name and the thing's functions. For example: *A living thing grows, reproduces, and is a user of water*. Just as common a beginning working definition may include only a category name and the thing's forms. For example: *A living thing is made of wood or meat.* A more advanced working definition would join these pieces. *A living thing* (category name) *is made of wood or meat* (forms) and *grows, reproduces, and needs water* (functions). Beyond this simple model, a maturing working definitions may also include examples, synonyms, pictures or diagrams, and other information. Pictures and drawings in particular greatly enhance deeper understanding of a working definition.

The Working Dictionary
The Working Dictionary is most often a book with blank pages, frequently loose leafed or big book format, used to keep a record of definitions. It is suggested that a single page be devoted to each concept or term defined so that ideas can be added or changed. Entries should be dated. Initials of major student contributors can be added to help the teacher in assessment of student understanding. Working definitions *can include incorrect information* since definitions will undergo regular re-evaluation at which time corrections can be made. This is how science operates—it is always changing, growing, refining.

STUDENT ROLE

Lexicographer

MATERIALS

Focus Book *THE FRIENDLY SHAPE* (Optional)
master collection from Activity SU.1 CLASSIFICATION
chart paper
markers
Student Page SU.2 WORKING DEFINITION

PRODUCTS

Working definitions
Completed Student Pages

PROCEDURES

1. **Review the ideas developed in Activity SU.1 CLASSIFICATION with the students.**

   Ask such questions as these:
   - What does *category* mean? Can you give some examples.
     ✔ Work for the name for the group to which something belongs.
     ✔ Use the master collection from SU.1 to help students come up with concrete examples.

   - What is meant by *form*? Can you give some examples?
     ✔ Work for the physical characteristics of the thing, the materials from which it is made, and the parts of which it is made up.

   - What is meant by *function*? Can you give some examples?
     ✔ Work for the use of the thing or what it does.

2. **Introduce the students to the idea of a working definition by reading some and having them identify the three parts. Working definitions include a category or name; a function or what the thing does or how it is used; and its form or physical properties, materials it is made of, and its parts or components.**

Use such definitions as these:

- A refrigerator is an appliance used for keeping things cold and making ice. It is usually box-shaped, comes in many colors, has a door with a handle and shelves, and needs electricity to operate.

- Markers are writing tools that come in many colors. They have different sized tips and usually look like pens. They can be washable or permanent and often have special smells. They can be used for writing or drawing on all sorts of things such as paper, clothing, and people.

- Spoons are kitchen utensils used for eating, serving, measuring and stirring. They can usually be held in one hand. They are made from metals, ceramic materials and plastic. They usually have a handle to hold on to with a bowl-shaped part at one end.

3. **Help the students write a working definitions for one of the items in the master collection from Activity SU.1 CLASSIFICATION. Record their definition on chart paper. Have them identify the category, form, and function by circling each in a different color.**

4. **Have the students work in small groups to write working definitions for other items in the master collection from Activity SU.1 CLASSIFICATION. Use Student Page SU.2 WORKING DEFINITION. Have the groups exchange papers and identify the category, form, and function in the other group's definition by circling each in a different color.**

5. **Introduce the Working Dictionary to the students when writing class working definitions. See Activity SU.3 LIVING AND NOT LIVING.**

6. **At the end of the school year store the Working Dictionary in the library for the students to build on the next year.**

DASH

WORKING DEFINITIONS SP SU.2

Name ______________________

Date ______________________

DASH SU.3 LIVING AND NOT LIVING THINGS

OBJECTIVES

The students
- Collect living and not living things.
- Describe and identify living, not living, never-living, once-living, and combination things and plants and animals.
- Write working definitions for living, not living, never-living, once-living, and combination things and plants and animals.

BACKGROUND

This start up activity follows Activities SU.1 CLASSIFICATION and SU.2 WORKING DEFINITIONS. This activity provides practice in classifying and writing working definitions as well as introducing several fundamental science concepts—living, not living, plants, animals, once-living and never-living. LIVING AND NOT LIVING THINGS also provides an opportunity to introduce the Wonder and Discover Book to students new to DASH.

The students first collect living and not living things. They classify their items to include the categories—living, not living, plants, animals, once-living, never-living, and combination things. Then they write class working definitions for these terms.

Student classification and working definitions

The concepts being introduced here are some of the most complex and difficult ones in science. The correctness and completeness of the classification and definition procedures suggested here will depend upon the prior experience and developmental level of the students. It is important to keep in mind that scientists themselves are not in complete agreement about these ideas. When questions arise they should be recorded in the Wonder and Discover Book.

STUDENT ROLES

Scientist
Classifier
Lexicographer

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MATERIALS

chart paper or a large sheet of oaktag
markers
clear plastic cups
recycled nylon stockings
baggies
3 X 5 cards
Working Dictionary
Wonder and Discover Book
Student Page SU.3 THE COLLECTION GAME

PRODUCTS

Classification chart about living and not living things
Working Definitions
Completed Student Pages

PROCEDURES

1. **Introduce the collection game. Have the students work in teams of two.**

    - Ahead of time divide a piece of chart paper in half. Label the two columns *Living* and *Not living*. Put the paper on a table. Figure SU.3 shows a suggested model for a finished chart. ✔ You may want to add a few items to the collection if the students do not collect them—something metal, a small rock, something plastic, a dead leaf, a dry seed, a piece of paper, a wood pencil with a metal eraser band, and a wood clothespin with a metal spring will help encourage the discussion.

    - Give each team a clear plastic cup or other container.

    - Have the students cover the cups with a piece of nylon stocking to let any animals they might collect breathe.

    - Instruct teams that they are to go outside and collect one living and one not living object to put in their container.

    - Have the students place their collected items in either the living or not living category on the chart paper.

2. **Discuss and expand the classification with the students.**

- Have them look at the items in each category and ask if they all agree with how things have been classified. Have the collector defend his choice of category.

- When there is agreement, have the students look at the living category and ask how it could be divided into just two groups.
✔ Work for *Plants* and *Animals*. There will hopefully be some disagreement from the purists who will suggest *Plants* and *Not plants* or *Animals* and *Not animals*. If needed remind the students of their two category or dichotomous classification activities. Both are correct although *Plants* and *Animals* are more commonly used.

- Divide the *Living* category column in two parts and label. Have the students place their living things into the two new categories.
✔ When they all agree, ask a few questions yourself about the dead leaf in the living category, the seed, and so forth.
✔ When there are unresolved questions, record them in the Wonder and Discover Book and create a new category for questionable items.

- Have the students look at the *Not living* collection. Ask if there is a way to divide the items into just two categories. Ask a specific question about the dead leaf and the piece of metal if needed.
✔ Work for the ideas of *Never-living* and *Once-living* things.
✔ There may again be some discussion from the purists who prefer *Once-living* and *Not once-living*. This is also correct although the former is more commonly used.

- Divide the *Not living* category column in two parts and label. Have the students place their not living things into the two new categories.
✔ When they all agree, ask a few questions yourself about the plastic in the never living category, the seed, and so forth.

- Pick up the pencil, clothespin or other combination item and ask where it belongs. Help the students to invent a Combination category and add it to the chart.

- Have the students attach items to the chart.
  ✔ Draw pictures of any live animals and return them to where they were collected.
  ✔ Bulky items can be placed in baggies and attached to the chart.

4. **Have the students write working definitions for living, not living, once-living, never-living, and combination things and plants and animals. Remind them to include category, form, function, and examples.**

   - Divide the class into seven groups and assign them a color to write with.
   - Give each group a sheet of paper from the Working Dictionary with a different category to define from the above list.
   - Have them write a working definition in their assigned color for their term.
   - After ten or so minutes have them pass their papers to another group in a round-robin fashion. The new group may make additions and corrections to the definition using their assigned color.
   - Continue this passing process every 2 to 3 minutes until all groups have worked on all the definitions or time runs out.
   - Have the original groups share the completed definitions, ask for any further input, and put the pages in the Working Dictionary.

5. **These definitions should be returned to periodically for revision.**

ILLUSTRATION

<table>
<tr><th colspan="4">All Things
(Matter)</th></tr>
<tr><th colspan="2">Living Things</th><th colspan="2">Not Living Things</th></tr>
<tr><th>Animals</th><th>Plants
(Not Animals)</th><th>Once Living Things
(Not Never Living)</th><th>Never Living Things</th></tr>
<tr><td rowspan="3"></td><td rowspan="3"></td><td></td><td></td></tr>
<tr><th colspan="2">Combination Things</th></tr>
<tr><td colspan="2"></td></tr>
<tr><th colspan="4">Wonder and Discover Things</th></tr>
<tr><td colspan="4"></td></tr>
</table>

Figure SU.3 A suggested model for a completed chart about classifying living and not living things.

DASH

LIVING AND NOT LIVING SP SU.3

Name ______________________

Date ______________________

All Things (Matter)			
Living Things		**Not Living Things**	
Animals	**Plants** (Not Animals)	**Once Living Things** (Not Never Living)	**Never Living Things**
		Combination Things	
Wonder and Discover Things			

2.1.11 THINKING

OBJECTIVES

The students
- Answer a questionnaire about the way they think when they solve a problem.
- Identify other ways they might have thought about that same problem.

BACKGROUND

This activity is designed to help students think about the way they solve problems. It should be introduced soon after the students have completed an invention activity. The students complete a questionnaire that focuses on the problem-solving process.

At this point in their development many students have not yet acquired the regular habit of thinking about a problem before they start to solve it. Asking questions about whether the students manipulate pictures and words in their minds as they invent draws attention to these kinds of mental processes. A visual imagery exercise is used to point up the power of these processes.

This activity can be used after any invention activity and several times if the ideas need reinforcement.

STUDENT ROLE

Psychologist

MATERIALS

Student Page 2.1.11 INVENTOR'S QUESTIONNAIRE

PRODUCTS

Completed Student Pages

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PROCEDURES

1. **Introduce the question "How did you think about your invention?" Help the students complete Student Page 2.1.11 INVENTOR'S QUESTIONNAIRE. To get at questions the students may have, the questionnaire may be read to them.**

2. **Have the students work in small groups to reflect on and then discuss their answers to the following questions.**

   - Did your members work about the same way when you were inventing?
   - How were the ways you worked similar? How were they different?
   - Did you do things that are not listed in the questionnaire? If so what were they?
   - Are there ways your group worked that could help others the next time you have an invention project?

3. **Have the students focus on their own thinking using mental pictures and words. Have them close their eyes and take them through a mental invention trip.**

   - Picture in your head going home this afternoon and opening the door that lets you into your home.
   - Look in front of you. What do you see? Look to the right. What do you see? Look to the left. What do you see? Keep looking at this picture in your mind.
   - Now look at the floor. You see a puddle of water that is getting bigger and bigger. Where do you think the water could be coming from?
   - The pool continues to get bigger and it's getting things wet. Picture in your mind what can happen to your home. What are you going to do?

4. **Have the students invent some scenarios in response to Procedure 3. Then discuss how they invented their stories.**

   Ask such questions as these:
   - Where did you think the water was coming from and what did you think you would do?
   - How many of you saw some kind of picture of your home, the water, and what you did to solve the problem of the water?
   - How many of you were talking to yourself as you were thinking about the problem?
   - Did anyone do something else as you thought about the situation? What did you do?
   - How was the way you worked with this thought problem similar or different from the way you did your invention?

5. **Provide the students with time before starting an activity to think about what is to be done and how they are going to approach the activity.**

6. **Give the students regular opportunities to walk through problem-solving situations emphasizing the visual and language components of mental operations.**

EXTENSIONS

Have the students
- Invent mind problems and share solutions.
- Read about famous inventors and how they worked to develop their inventions.
- Make a bulletin board about famous inventors.

DASH

INVENTOR'S QUESTIONNAIRE
SP 2.1.11

Name: ______________________

Date: ______________________

Ask the following questions about your invention. Check YES if you did the thing asked about and NO if you did not do the thing asked about.

QUESTION	YES	NO
1. Did you stop and think about what you were going to do before you started to work?		
2. Did you work with the things before you got the idea for your invention?		
3. Did you watch what other people were doing to get ideas?		
4. Did you picture in your head what you were going to do?		
5. Did you talk to yourself in your head about what you were going to do?		
6. Did you draw a picture of what you were going to make before you made it?		
7. Did you talk to anyone to see what they thought about your ideas?		
8. Did you write down anything about your invention?		
9. Were you ever unsure as to whether you could make an invention?		
10. Could you make your invention work even better now?		
11. Could you make a different invention that could do the same thing as the one you have just finished?		

K.2.7 MOON PHASES

OBJECTIVES

The students
- compare time between two full moons with the time between two new moons
- observe, report, and record phases of the moon from new moon to new moon
- sequence moon phases
- identify the moon cycle as one of nature's clocks
- make a Moon Clock

BACKGROUND

MOON PHASES should follow Activities K.1.1 THE LEARNING CALENDAR, K.2.2 BEGINNINGS, K.2.3 ENDINGS, K.2.4 DAY AND NIGHT, K.2.5 DAYS, WEEKS, AND MONTHS, and K.2.6 MOON WATCH and should precede K.2.9 CLOCKS AND CALENDAR. In MOON PHASES the students again observe the phases of the moon starting with the new moon and then construct a Moon Clock. Families are once more asked to participate.

Connections with MOON WATCH

In the previous activity, K.2.6 MOON WATCH, the students counted the days between two *full* moons. Here they count the days and watch the phases between two *new* moons. The students find that the period of time between the new moons is about the same as the period between full moons. Special focus here is on the phases of the moon and their order. Observations are used help make a Moon Clock.

Moon phases

The moon phases follow in an ordered sequence. Starting with the new moon there are eight phases; the first crescent phase, the first quarter phase, the first gibbous phase, the new moon, the last or shrinking gibbous phase, the third quarter phase, the last crescent phase, and then back to the new moon. See Student Page K.2.7E MOON PHASES AND SHAPES. More formal study of moon phase will be carried out in
DASH 1.

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When to use
MOON PHASES can be used anytime after Activity K.2.6 MOON WATCH; however, to get maximum reinforcement of ideas it is best done in the next moon cycle. If the students are already doing a second full-moon-to-full-moon day count as a continuation of K.2.6 MOON WATCH, continue it and concurrently begin the new study. Emphasize that this is a different count with different objectives. The students are now trying to find out whether the day counts between full moons and between new moons are the same or similar and the sequence of phases in the moon cycle.

STUDENT ROLES

Astronomer
Record keeper
Chronologist
Clock maker

MATERIALS

Learning Calendar
markers
crayons
glue
paper plates
brass fasteners
index cards
hole punch
chart paper
letter to families
Student Pages K.2.7 A NEW MOON
K.2.7 B-C SEQUENCE CARDS
K.2.7 D MOON CLOCK
K.2.7 E MOON PHASES

PRODUCTS

Class chart about moon phases
Moon Clocks (several will be needed in Activity K.2.9)
Completed Student Pages

PROCEDURES

1. **Review the results of Activity K.2.6 MOON WATCH with the students.**

   Ask such questions as these:
   - How many days did we find between two full moons?
     ✔ Introduce the idea that this is a *moon cycle* or changes in the moon that happen between full moons.
   - What did the moon look like during the moon cycle?
   - When is the best time to watch the moon?
   - Did you ever see the moon during the day?
   - What does a *new moon* look like?
   - What does a new baby look like compared to you or an adult?
     ✔ Get at size.
   - Was there a time when the moon was very small? What did it look like?
     ✔ Identify this as the time of the new moon.

2. **Discuss the questions, *Do you think the number the days from one new moon to the next new moon will be different from the count of days from full moon to full moon?* and *What are the moon's shapes or phases over this cycle?***

   Help the students do the following:
   - Predict the number of days from one new moon to the next. Record their predictions on Student Page K.2.7A NEW MOON.
   - Describe and discuss the various shapes (phases) the moon had in their last study.
   - Tell what they think the moon phases will look like when they study them again.

3. **Again ask the families to help their children observe the moon whenever possible. See the sample letter in Fig. K.2.6.**

- Send a note to families explaining the continuing assignment. Include Student Pages K.2.7A NEW MOON and K.2.7E MOON PHASES .

- Beginning with a new moon, have the students identify the moon phases, count the days until the next new moon, and record the phases in pictures.
  ✔ Use Student Page K.2.7A to record their observations.

4. **Have the students report and record their data on the Learning Calendar.**

Help them
- Draw the moon phases on the Learning Calendar.
  ✔ Ask, What was the shape of the moon?

- Name the phases as specific shapes are identified by the students.
  ✔ See the Student Page K.2.7E MOON PHASES for names.
  ✔ The concepts of waxing and waning will be introduced in *DASH* 1.

- Mark the starting *new moon* or the *beginning* of a cycle.

- Draw the moon phase for each day they see the moon.

- Mark the next *new moon* or the *ending* of the cycle.

- Count the days between new moons.

- Record the count on their calendar.

5. **Discuss the results of the moon watch with the class.**

Ask such questions as these:
- How many days are in a moon cycle starting with the new moon?

- How many days are there from the new moon to the full moon?
  ✔ There will be about 14 (13–15).

- How many days are there from the full moon to the new moon?
  ✔ There will be about 14 (13–15).

- What are the moon phases in the order you saw them?

- How are the moon phases alike? How are they different?
- How many days were there in the cycle we observed from full moon to full moon?
  ✔ There were between 28 and 31 days, depending on the interpretation of "new moon." The astronomical time is about 29 1/2 days.
- How are the full-moon-to-full-moon and the new-moon-to-new- moon cycles alike?
  ✔ Their counts should be about the same.
- How are they different?
  ✔ Get at the idea that they have different starting points in the same cycle.

6. **Have the students work in groups to cut out the set of large moon phases from Student Pages K.2.7B and K.2.7C SEQUENCE CARDS and put them in order.**

   - Some students may arrange the cards in a linear sequence while others may form a circular sequence.
   - Have them share and explain their sequences.
     ✔ Encourage the students to make any modifications they wish.

7. **Help the students organize to make a moon clock. Have them cut out the set of small moon phase pictures from Student Page K.2.7D MOON CLOCK.**

   - Ask the students where they would place or draw the new and full moon cutouts on their paper plate.
     ✔ Note that the period between a new moon and a full moon is half a cycle, so they would place the new moon across from the full moon on the plate.
   - Help the students lay the rest of the moon phase cutouts in order on the clock face.
     ✔ Ask them where the quarter moons go, where the crescent moons go, and finally where the gibbous moons go.
     ✔ Use the sequence cards for reference.

8. **Help the students make the clock.**

   Help the students do the following:

- Make a clock by drawing or gluing their set of cutouts onto the plate.
- Cut index cards into strips to make pointers.
- Cut a point at one end of a strip and punch a hole in the opposite end with a punch or nail.
- Mark the centers of their paper plates and make holes through the center of the plate.
  ✔ You may want to punch the hole in the plate.
- Attach the pointer to the clock face with a brass fastener.

9. **Have the students test to see whether their clocks are accurate. Save several moon clocks for Activity K.2.9 CLOCKS AND CALENDARS.**

   Help them do the following:
   - Direct the pointer to the current moon phase.
   - Move the pointer to show the next phase. If their clocks are accurate, the pointer will move in the same order as the moon phases appear.
   - Re-do the clock if necessary to correspond to their observations.
   - Look at subsequent moon cycles as a way of validating their data.

EXTENSIONS

- Read Frank Asch's *Happy Birthday Moon.*
- Celebrate the moon's birthday. Point out that the new moon is the beginning of another cycle and another birthday. Have the students join in the planning.
- Have the students make a large class moon clock.

SAMPLE LETTER

Dear Family:

Our kindergarten class is again observing the moon. This time we will start with the new moon, which will appear in the sky about ____________________.

Enclosed is another moon observation sheet. In addition to investigating the length of the moon cycle starting from different phase, this time we will be paying closer attention to the shape and sequence of the phases. Please help your child to make the drawings. We will also be giving names to the different phases. An information sheet is attached for your reference.

Again there may be times when cloud cover will make observation impossible. Have your child invent a way to show times when no observation was made. The moon will usually be visible in either the early evening or early morning.

Thanks for your help. Please send the observation sheet back to school after the moon watch is completed. Have fun observing with your child.

Fig. K.2.7 Moon Phase sample letter

SP K.2.7A

DASH

NEW MOON
SP K.2.7A

Name ______________________

Date ______________________

Prediction	Observation
I think it will be ____ days until the next **new** moon	I counted ____ days from one **new** moon to the next.

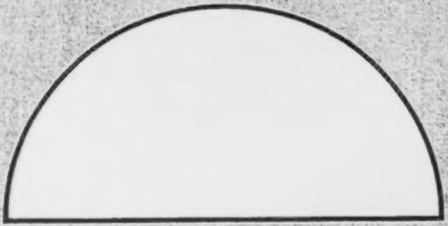
new ●	○	○	○	○	○	○
○	○	○	○	○	○	○
○	○	○	○	○	○	○
○	○	○	○	○	○	○
○	○	○	○	○	○	○

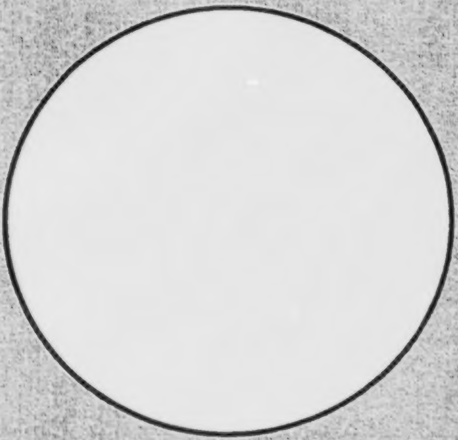
DASH

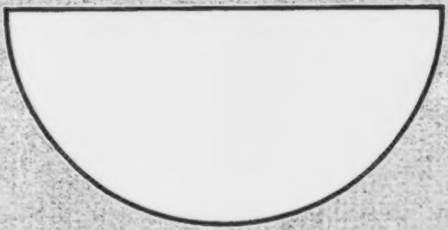
SEQUENCE CARDS SP K.2.7B

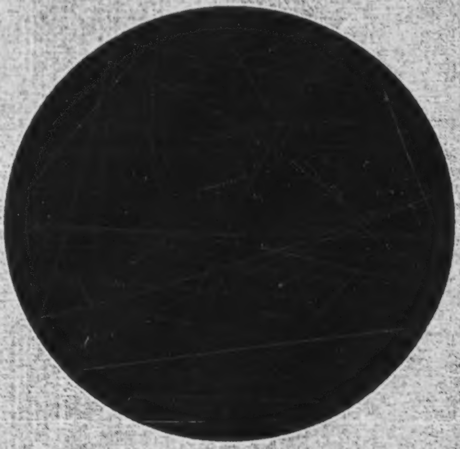
Name ______________________

Date ______________________







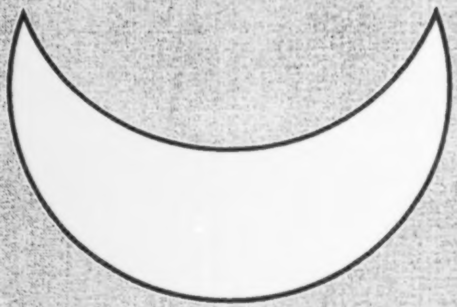


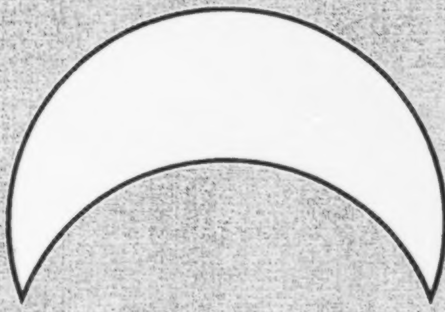
DASH

SEQUENCE CARDS SP K.2.7C

Name ____________________

Date ____________________



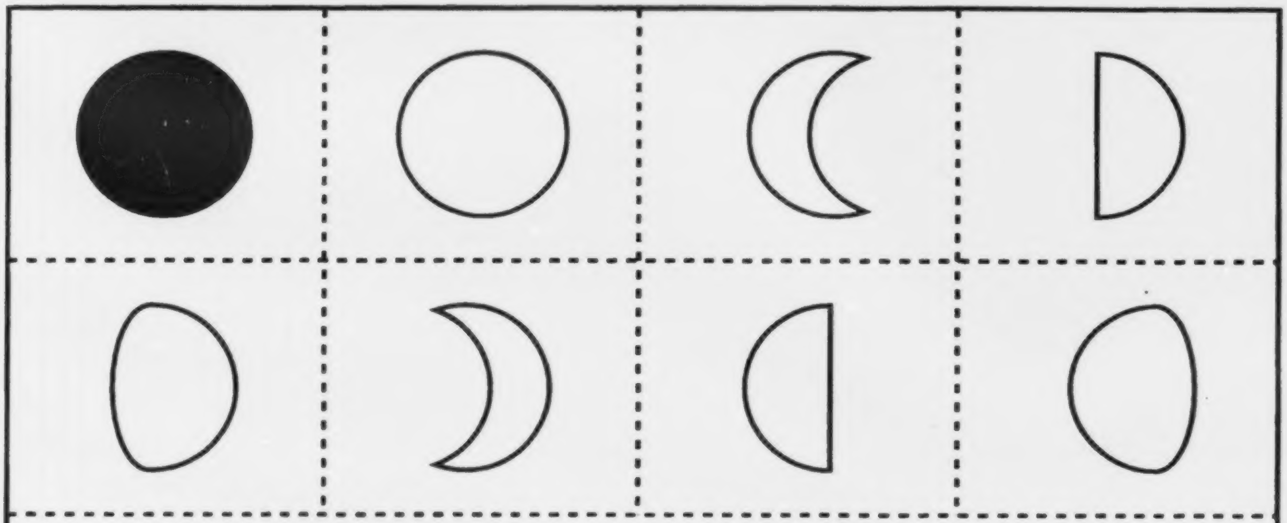


DASH

MOON CLOCK
SP K.2.7D

Name ______________________

Date ______________________

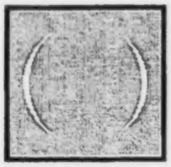


DASH

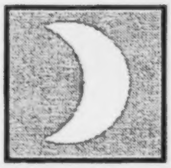
MOON PHASES
SP K.2.7E

Name ____________________

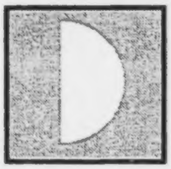
Date ____________________



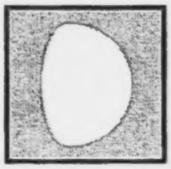
NEW: darkened or very dimly lit.



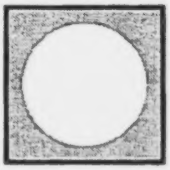
CRESCENT: smaller than half of the moon's face.



QUARTER: half of the moon's face is visible.



GIBBOUS: appears larger than a quarter moon yet is not full.



FULL: entire face of the moon is seen.

1.2.8 NIGHT AND DAY

OBJECTIVES

The students

- Collect data about sunlight and seasonal change.
- Observe that the length of one day-and-night cycle is about 24 hours.
- Correlate changing length of day with seasonal changes.
- Correlate day and night length with solstices and equinoxes.
- Practice using digital time.

BACKGROUND

This year-long activity should be started about 2 weeks after sunrise and sunset data collection becomes routine. Students convert the data from Activity 1.2.7 SUNRISE AND SUNSET into linear representations of time with string or tape. The string or tape can be colored with marking pens, crayons, or even chalk.

During the year a series of correlations are made as students work toward an understanding of seasons.

STUDENT ROLE

Astronomer

MATERIALS

class chart day and night
tape or string
yellow and black crayons, markers, or chalk
stapler
time line from Activity 1.2.6 TIME LINE
scissors
glue
Student Pages 1.2.8A CLASS TIME LINE
1.2.8B DAY AND NIGHT IN SUMMER

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PRODUCTS

Class chart day and night
Class time line
Completed Student Pages

PROCEDURES

1. **Establish the need for the class chart day and night.**

   Have the students construct a month-by-month time line for the chart using Student Page 1.2.8 CLASS TIME LINE.

   Ask such questions as these:
   - What seems to have happened to the length of the day since we have started keeping records?
   - How can we tell?

2. **Demonstrate using the digital time line from Activity 1.2.6 TIME LINE to represent the daylight hours between sunrise and sunset. See Figure 1.2.8.**

   - Cut a piece of tape or string as long as the 24-hour time line.
   - Place the tape along side the time line.
   - Mark the times of sunrise and sunset on the tape.
   - Color the tape yellow between sunrise and sunset.
     ✔ Day.
   - Color the remainder of the tape black.
     ✔ Night.
   - Attach the tape to the chart under the appropriate date on the class time line.

   Have each group make one or more representations of daylight length for previously collected sunrise and sunset data.

   A new tape should be added to the class chart at least once each week.

3. **Discuss correlation 1, days get shorter and nights get longer in fall.**

   Explore the length of night and day after a month.

   Ask such questions as these:
   - How long is the night?
   - How long is the day?
   - What is happening to the length of the day and night?

4. **Discuss correlation 2, the length of day plus the length of night are equal to about 24 hours.**

   Ask such questions as these:
   - How long a time is it from sunrise to sunrise?
   - How can we find out?
     ✓ There are several ways: (a) Measure directly on the time line. Put 2 time lines together using one as a time ruler. (b) Put night and day tapes end to end and measure on the time line. (c) Calculate.

5. **Discuss correlation 3, the lengths of day and night are the same on September 23, the first day of fall.**

   - Around the middle of September have students find out the date of the first day of fall.
   - Have students predict what might happen to the length of day and night on that date.
   - After the date have students make correlations between the equinox and the first day of fall.

6. **Have students record their predictions about what will happen next to the length of day and night on the Learning Calendar.**

   - Watch to see whether their predictions are correct.
   - Have students continue to make predictions after each discussion.

7. **Discuss correlation 4, December 22, the first day of winter, has the longest night and the shortest day.**

   - Two weeks before Christmas vacation, ask students to find out when the first day of winter will be.
     ✔ Suggest that they may use the radio, TV, newspaper, their parents, etc., as information sources.
   - Continue sunrise and sunset data collection over the vacation.
   - On return from vacation, correlate day and night length with the first day of winter.

8. **Discuss correlation 5, days get longer and nights shorter as the winter progresses.**

   Begin any time after the students return from Christmas vacation.

   Ask such questions as these:
   - What seems to be happening to the length of the day?
   - When did this seem to start?
   - How long do you think this will go on?

9. **Discuss correlation 6, the lengths of day and night are the same on March 21, the first day of spring.**

   - Around the beginning of March ask students to find out when the first day of spring will be.
   - Ask students to predict what will happen to the length of day and night on that day.
   - After the event make correlations between the equinox and the first day of spring.

10. **Discuss correlation 7, days continue to get longer and the nights shorter in the Spring.**

    A week or so after the Spring Equinox ask such questions as these:
    - What is happening to the length of the day?
    - How long do you think this will go on?

- Can you predict when there might be a change?

11. **Right before summer vacation, challenge students to find out if and when the days start to get shorter again over the summer.**

    Use Student Page 1.2.8B DAY AND NIGHT IN SUMMER to record data.

EXTENSIONS

- Have students make a day-and-night graph for shorter time intervals. Have them graph data every day or every other day.
- Have students record the total time from sunrise to sunrise on the Learning Calendar. Students may notice the times are a bit longer than 24 hours for some seasons and shorter for others.

ILLUSTRATION

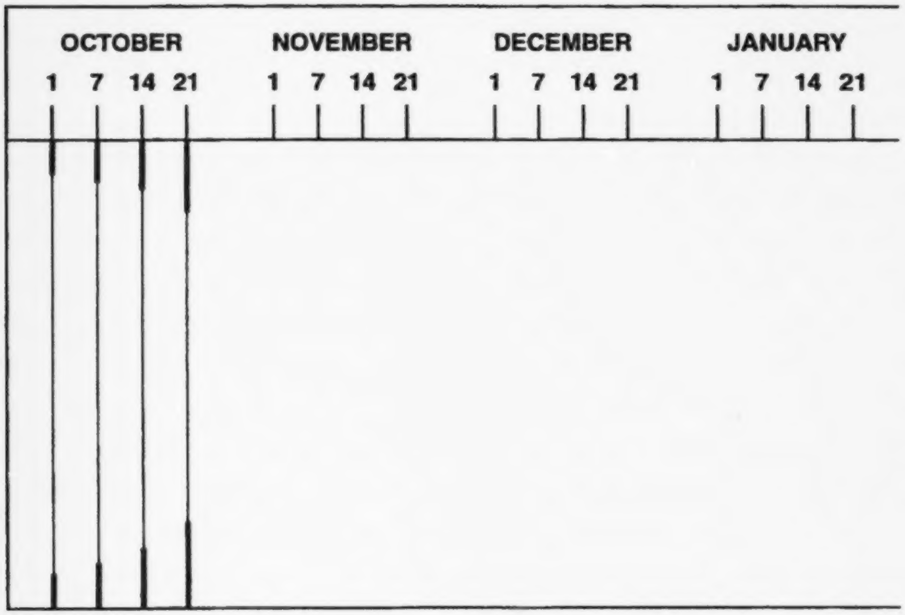


FIGURE 1.2.8 Night and Day

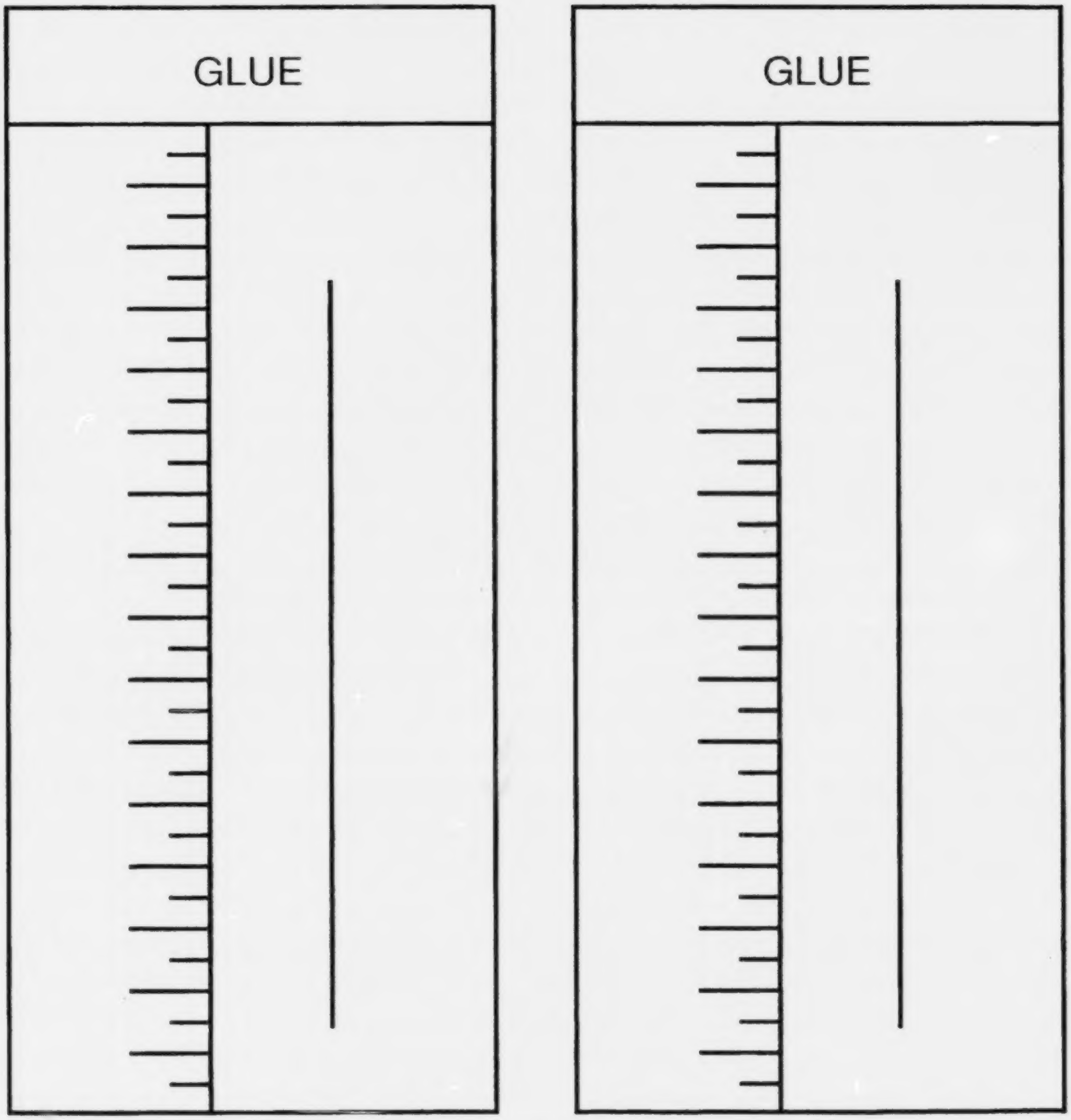
SP 1.2.8A

DASH

CLASS TIME LINE 1.2.8A

Name: ______________________

Date: ______________________



Cut one strip for each month. Each one-half centimeter is equal to one day. Cut off excess for months with fewer days. Label months. Glue strips together. Begin with current month.

DASH

DAY AND NIGHT IN SUMMER
1.2.8B

Name: ______________________

Date: ______________________

DATE	SUNRISE	SUNSET	OBSERVATIONS

2.2.7 DIGITAL TIME

OBJECTIVES

The students
- Review how to read a digital clock.
- Make a 24 hour digital time line.
- Learn how to use a digital time line to find the time between events.
- Calculate the time between events.

BACKGROUND

Digital time is introduced in DASH 1. Now students learn to calculate lapsed time or the time between start and finish using multiple time lines. In the DASH 2 we also introduce analog time for the calculation of time lapse.

Review

DIGITAL TIME is designed to be used with Activities 2.2.3 SUNRISE, SUNSET, AND SEASONS, 2.2.4 MOONRISE AND MOONSET, and 2.2.8 ANALOG TIME. Digital and analog clocks are tools. In keeping with the general philosophy of DASH, the use of tools is taught in the context of an activity in which the tools are used. Such an approach provides the students with an immediate reason for mastery of the tool and an environment in which to explore and practice its use.

The 24 Hour Time Line

Two common methods of reporting time are in two 12 hour intervals before and after noon (A.M. and P.M.) and in one 24 hour interval. The later is used extensively by the military. Both methods are used here. Conceptually the 24 hour interval is actually easier for students to grasp and can be used before introducing the A.M. and P.M. method.

No DASH 1 Background

Some students probably will not have had DASH 1, so this activity may be their first exposure to digital time. It will accelerate mastery if these students are paired with students who have previously worked with digital time.

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Time Intervals
Time intervals can be determined by using two time lines. Use one time line to mark the beginning and end of the interval to be measured. Use the second timeline as a ruler. Place the 0 hour of the ruler at the beginning of the interval and then measure the number of hours and minutes to the end of the interval.

STUDENT ROLES

Astronomer
Mathematician

MATERIALS

digital class clock
digital watches
scissors
glue
pencils
markers
Student Page 2.2.7 DIGITAL TIME LINE

PRODUCTS

Time lines

PROCEDURES

1. **Introduce the activity by showing a digital clock.**

   Ask such questions as these:
   - Can anyone tell us what time it is now? Reset the clock and repeat the question several times.

   - Can anyone tell us how to read a digital clock?

   - Go to the P.M. readings. Can anyone tell us what P.M. stands for?
     ✓ Work for two ideas—the literal translation, *post meridian*, meaning after the sun passes overhead at noon, and that it tells us when it is afternoon and evening.

- Go to the A.M. readings. Can anyone tell us what A.M. stands for?
  ✔ Work for two ideas—the literal translation, *antemeridian*, meaning before the sun passes overhead at noon, and that it tells us when it is morning.

- Can anyone tell us when the clock changes from A.M. to P.M.? What time is that?
  ✔ Work for noon.

- Can anyone tell us when the clock changes from P.M. TO A.M.? What time is that?
  ✔ Work for midnight.

2. **Introduce Student Page 2.2.7 DIGITAL TIME LINE. Each time line will require 8 copies, there being 3 strips on a copy. One strip equals one hour.**

   Help the students
   - Assemble their time lines.

   - Label A.M. and P.M. on the time line.
     ✔ A different colored stripe along one edge of the timeline can be used for A.M. and P.M.

   - Number as a 24-hour digital time line.

3. **Use the digital time line with Activity 2.2.3 SUNRISE, SUNSET, AND SEASONS and 2.2.4 MOONRISE AND MOONSET to measure the time between rising and setting events. Two or more time lines will be needed.**

   Have the students
   - Mark the time of rising and setting on one time line.

   - Use another timeline to measure the interval between rising and setting.

EXTENSIONS

- Suggest to parents that an analog watch makes an ideal present for students.

- For students who have both an analog and a digital watch, suggest that they wear both. Form a "Two-Watch" club.

- Label one class timeline with both 24 hour time and A.M. and P.M. times for easy conversions from one system to the other.

DASH

DIGITAL TIME LINE
SP 2.2.7

Name: ____________________

Date: ____________________

GLUE	GLUE	GLUE

2.2.8 ANALOG TIME

OBJECTIVES

The students
- Relate digital time readings to analog time readings.
- Construct a model of an analog clock.
- Explore the use of the analog clock.
- Practice using the analog clock.

BACKGROUND

The digital clock was introduced in DASH 1 and is use in DASH 2. In DASH 2 the analog clock is introduced for the first time. DASH employs this sequence because the digital clock is usually much easier for students to learn and many have prior experience with it. Knowing how to read digital time makes analog time much easier to master. However, there are disadvantages to digital clocks. They are unidirectional; one can read only time after the hour directly from a digital clock and one has to perform mental arithmetic to calculate time before the hour. Further digital clocks are not always available and students need to know both systems.

In keeping with the general philosophy of DASH concerning the teaching of tools, time is taught in a context in which it is used. The analog clock can readily be introduced whenever an activity involves time. Practice is natural whenever the time of day needs telling.

ANALOG TIME should follow 2.2.7 DIGITAL TIME. It should not be introduced until newcomers to DASH have gained some proficiency in reading digital time. To ensure that the analog clock is used, it is suggested that any digital clocks be removed from the room while the reading of analog clocks is being mastered.

STUDENT ROLE

Timekeeper

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MATERIALS

time lines from Activity 2.2.7 DIGITAL TIME
analog clock
paper plates for clock faces (preferably without indentations in rim)
paper fasteners
index cards to make hands
scissors
pencil
Student Page 2.2.8 ANALOG CLOCK

PRODUCTS

Analog clocks

PROCEDURES

1. **Set the stage by announcing that because we have to give up our digital clocks and rely upon analog clocks for the next month, the students will need to learn to read an analog clock.**

   Ask such questions as these:
   - Does anyone know what an analog clock is?

   - Does anyone know how to read an analog clock?
     ✔ Those who do can be your assistants.

2. **Turn a digital time line into an analog clock by shaping it into a circle and adding hands. Ask what has been made?**

3. **Have the students make a 12-hour analog clock face using Student Page 2.2.8 ANALOG CLOCK.**

   Have them
   - Cut out the face and glue it to a paper plate.

   - Attach the minute hand with a brass paper fastener.

4. **Have the students inspect their analog clocks.**

   Help them
   - Recall that there are 60 minutes in an hour.

- Discover that there are 12 large lines on the clock face for numbers.
  ✔ Have them write in the numbers 1–12 on their clock face.

- Discover that there are 12 groups of 5 minutes each represented on the face and that their total is 60 minutes.
  ✔ Practice counting by five's.

- Discover that they can count by 5 and single minutes to find the total number of minutes past the hour.
  ✔ Practice with different settings.

5. Have the students remove the fastener and add the hour hands to their clocks and practice time settings.

With them
- Go over hour settings for one o'clock and two o'clock, then help the students discover other hour settings.

- Introduce a setting for 5 minutes after one o'clock, then help the students discover the remainder of the series of minutes in-5 minute intervals.

- Help the students discover how to set the clock for other intervals by giving them practice challenges.
  ✔ Have students help each other.

- Introduce half and quarter hours.

- As soon as possible get the students to use their new knowledge in the role of Time Keepers.

6. When the students are proficient, help them discover that analog clocks can also be read in terms of minutes *before* the hour. Have the students use their clocks.

Ask such questions as these:
- If someone asks *How many minutes is it before twelve o'clock?* when the clock reads 45 minutes after eleven, how could you figure out the answer?
  ✔ Have students help each other to solve this and other such challenge times.

- When might we want to know how long it will be before twelve o'clock?
  ✔ Practice before-the-hour readings.

EXTENSIONS

- Have the students play Time-Set games.
  Game 1. Give the students a challenge time of so many minutes *after* the hour. Allow them 30 seconds to set their clocks. After a while give them 25 seconds to set them, then 20 seconds and so forth down to about 10 seconds.

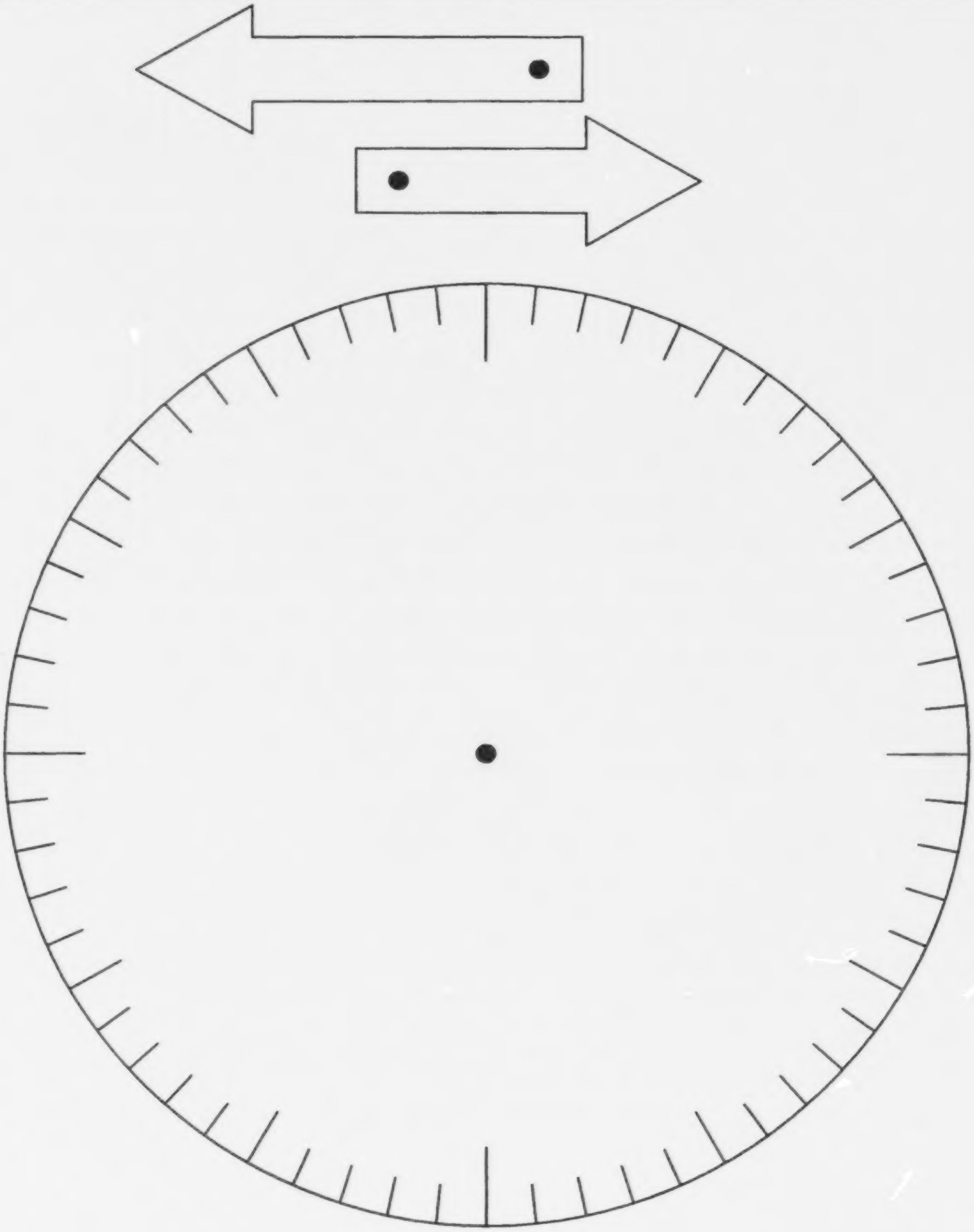
  Game 2. Give the students a challenge time of so many minutes *before* the hour. Allow them 30 seconds to set their clocks. After a while give them 25 seconds to set them, then 20 seconds and so forth down to about 10 seconds.

DASH

ANALOG CLOCK
SP 2.2.8

Name: ____________________

Date: ____________________



K.3.9 PARTS OF BUGS

OBJECTIVES

The students
- identify external bug body parts and their functions
- observe how different kinds of bugs walk

BACKGROUND

PARTS OF BUGS is one of a series of activities on external anatomy. It should follow Activity K.3.8 HOW BUGS WALK and precede K.3.10 PARTS OF MAMMALS and K.3.11 PEOPLE.

The students pursue the question, *What are the external body parts of bugs?* To do this, they go into the field and observe bugs where they live. This is also a time to look further into how bugs walk.

Parts of bugs

The students were introduced to five different kinds of bugs or arthropods and some of their characteristics in Activity K.3.8 HOW BUGS WALK. In that activity, the students simulated the walking of insects, which have 6 legs; spiders, 8; crustaceans, 10–20, centipedes, 50-60; and millipedes, 80–400. They have felt the movement of segmented bodies made of jointed parts that allow arthropods to bend. They have heard that all bugs have eyes, and all but spiders, antennas.

Possible observations

Identification of body parts and other observations that may be made about various bugs are listed below:

- Insects have three big body divisions seen as separate bulges—the *head*, the *thorax*, and the *abdomen*, the same divisions we have in our body. The abdomen and thorax of insects consist of several segments. Six legs are attached to the thorax. Insects may also have wings.

- Spiders and their relatives have two big body divisions seen as separate bulges—the *cephlothorax*, a fused head and thorax, and an *abdomen*, and 8 legs. Scorpions are members of the same group as

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spiders and have eight legs and two pincers and a segmented abdomen with a poison tip.

- Crustaceans have two big body divisions seen as separate bulges—the *cephlothorax*, a fused head and thorax, and an *abdomen*. The abdomen is often divided into many segments, for example in the isopod called a pill bug. Leg counts can run from 10–20. Many water-dwelling members such as the crayfish and lobster have claws.

- Centipedes and their relatives have a *head* and a single pair of legs from each of 24–30 body segments with a total leg count of 48–60.

- Millipedes and their relatives have a *head* and two pairs of legs from each of 20 to 100 body segments with a total leg count of 80–400.

Do not expect the students to find all body parts at this time. Though most students will quickly pick up new words, this is not a vocabulary lesson, and they should concentrate on the nature of the structures rather than their particular names.

Handling and housing bugs
The students *should not* handle spiders, scorpions, centipedes, or millipedes. Until they can distinguish between different bugs, have them scooped into containers. To keep organisms from escaping from a container, cover the mouth with nylon hose or plastic wrap with holes to allow air to enter. For viewing, use a clear plastic cup.

Have the students mark where all bugs they collect are found with a flag on a skewer. Return the organisms to the environment as soon as possible.

Magnifying glasses
Have the students practice with their magnifiers before they go into the field. Have them explore

- how to focus the magnifier by moving it up and down
- how close they must get their eye to the magnifier
- how different magnifiers provide different amounts of magnification

Detailed study to insects
It is suggested that the detailed study of bugs can be limited to insects though study of other bugs is encouraged. Often there will not be enough specimens to allow study of other kinds of bugs.

Bug models
Models of insects and other bugs can be made using a wide variety of recycled materials, glue, and tape. Put materials into an Inventor's Box and appeal to the imagination of the students.

STUDENT ROLES

Entomologist
Zoologist
Biologist

MATERIALS

- resealable bags
- clear plastic cups
- recycled nylon stockings
- skewers
- small fabric or yarn streamers.
- plastic wrap
- tape
- glue
- spoons
- gloves
- materials for bug models:
  - Styrofoam
  - clay or Play Dough
  - straws
  - egg cartons
  - small boxes
  - tubes
  - other as requested or brought in by students
- magnifying lenses
- Student Pages K.3.9A INSECT
  K.3.9B BUGS

PRODUCTS

Completed class chart about ways bugs walk from Activity K.3.8 HOW BUGS WALK.
Bug models
Completed Student Pages

PROCEDURES

1. **Introduce the use of a magnifying glass or hand lens.**

   Have the students do the following:
   - Hold the magnifying glass close to object to be viewed.
   - Slowly move the magnifying glass up toward the eye until the object comes into focus.
   - Practice with various objects.
     ✔ A center where hidden things can be looked for in sand, soil, or fish gravel provides a good place to practice.

2. **Prepare for the field experience.**

   - Make marker flags and temporary cages.
   - Discuss field safety.
     ✔ How animals are to be observed and handled.
     ✔ What kinds of animals to tell you about.

3. **Return to the rhyme *We Are Bugs* from Activity K.3.8 HOW BUGS WALK and help the students recall how they can tell whether they have found insects, spiders, crustaceans, centipedes, or millipedes.**

4. **Have the students take hand lenses and go into the field and observe bugs.**

   Have them do the following:
   - Look for insects, spiders, crustaceans such as the isopods—sow bugs, centipedes, and millipedes.
   - Notice the kinds of places they are found.
   - Observe how each kind of bug walks.
   - Return to the classroom and tell what they have found.

5. **Have the students take containers with covers and flags and return to the field to collect insects and bring them into the classroom. Have them get as *large* an insect as possible.**

   Have the students do the following:
   - Scoop up insects carefully and gently.
     ✔ They can usually be scooped up with the containers.

- Cover the container for viewing.

- Put a flag where an insect is collected.

6. **Have the students observe their insects as you lead a discussion.**

Ask such questions as these:

- How do you know that you have an insect?
  ✓ Get at the number of legs.
  ✓ Use a magnifying glass as necessary.

- Can anyone show us the head of your insect?

- How do you know it is the head.
  ✓ Probe for the idea that this is where you find what look like eyes, and antennas.

- Can anyone show us where your chest is?
  ✓ Ask if anyone knows another name for chest, one that doctors sometimes use. If needed, give them the name *thorax* and write it on the board.

- Insects have a thorax, where might it be?
  ✓ Work to the idea of being below or right behind the head.

- Does anyone who has insects find a bulge in the back of the head or behind it? Can you show us?
  ✓ The thorax will be quite prominent on insects such ants and those that fly and less prominent on beetles.

- Does anyone know what doctors call your tummy or belly?
  ✓ Work to the idea of an *abdomen*. Write *abdomen* on the board.
  ✓ Point out that insects have a separate abdomen.

  Does anyone find a bulge in back of or behind the thorax? Can you show us?
  ✓ The abdomen will be quite prominent on insects such as ants and those that fly and less prominent on beetles.

- Where on our insect do the legs seem to be attached?
  ✓ This will be on the thorax. However, there will be a lot of movement and this may be difficult to see.

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- Does anyone see anything else on your insect.
  ✔ Get at such things as wings, mouth parts, and antennas.

7. **Have them draw and label a picture of their insect on Student Page K.3.9A INSECT. Include labels for the head, thorax, abdomen, wings, antennas, eyes, and legs.**

8. **Have the students return their insects to the place they found them.**

   - When observations are complete, return the insects to where they were found.

   - Collect flags.

   - If there is time, other bugs can be investigated the same way.

9. **Have the students make three-dimensional models of a bug. Use recycled materials.**

   Help the students do the following:
   - Label the parts of their models.

   - Display and explain their models to the class.

10. **Summarize the activity using Student Page K.3.9B BUGS.**

    Ask such questions as these:
    - How many different body parts do different bugs have?

    - How did each kind of bug really walk?
      ✔ Probe to see whether their bugs walked as they predicted and fill out the observations of the chart about the ways bugs walk from Activity K.3.8 HOW BUGS WALK.
      ✔ You may want to do the bug walks again and modify movements.

EXTENSION

- Set up a center where students can use a magnifying glass center to observe insects and other bugs. Once created, it can be used anytime there are interesting things to see enlarged.

DASH

INSECT
SP K.3.9A

Name ______________________

Date ______________________

Draw your insect. Label the head, thorax, abdomen, leg, eye, wing, and antenna.

BUGS
SP K.3.9B

Name ____________________

Date ____________________

PICTURES	HOW MANY				
	LEGS	BODY PARTS	EYES	ANTENNAE	WINGS
INSECT					
SPIDER					
CRUSTACEAN					
CENTIPEDE					

K.4.4 GROWING BEAN SPROUTS

OBJECTIVES

The students
- investigate the structure of seeds
- discover the parts of plants into which different parts of the embryo will mature
- investigate a way to grow bean sprouts

BACKGROUND

GROWING BEAN SPROUTS is one of a series of activities on the study of plants. It is designed to be done concurrently with K.4.5 PLANTS AND WATER and K.5.1 BEAN SPROUT SALAD and before K.4.6 GARDENING. Other activities in the series are K.4.1 PLANT PARTS, K.4.2 PLANT ENVIRONMENTS, and K.4.3 PLANT USES.

In this activity the students first investigate the structure of a lima bean. This can be done any time before the study of sprouting. Then they follow the development of mung beans or other sprouting seeds for 5 days. At the end of the 5 days they eat the remaining sprouted seeds. See Activity K.5.1 BEAN SPROUT SALAD.

Lima bean anatomy

Soak lima beans overnight. Have the students examine a bean to find seed parts. Because lima beans are large, their parts are easily identified. See Fig. K.4.4. When the students examine their mung bean they will find that it has the same parts.

Concurrent studies

On Day 1 of this investigation 660–700 (about half a cup) of mung beans or other seeds are soaked overnight. Thirty or so dry seeds are saved for later dissection. On Day 2, two batches of seeds are wrapped in separate growing cloths. One batch contains 600 seeds; the other, 60–100 seeds. Starting on Day 3, the 60–100 seeds are not watered. The fate of these unwatered seeds is followed in Activity K.3.5 PLANTS AND WATER, which continues beyond GROWING BEAN SPROUTS through Day 8 or longer.

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The number of seeds is based on a class of 25 students, each using one germinating seed per day in each experiment and the remainder for the salad activity. There is usually 85% to 90% germination with fresh seed. Sprouting seed needs to be kept in a fairly warm environment of about 70° F for optimum growth.

The larger batch of 600–650 seeds is watered throughout this investigation with the final observation occurring on Day 5. On this same fifth day, Activity K.5.1 BEAN SPROUT SALAD is carried out using the remaining watered bean sprouts. GROWING BEAN SPROUTS can be extended several more days, but the eating quality of the sprouts will deteriorate over time.

Selection of seeds for sprouting
Mung beans are suggested for use in this experiment because they are commonly found in salads. A half cup of dried mung beans will normally be sufficient for all investigations. Because mung beans are small, the students will need hand lenses for their first observation. If mung beans are not available, try other types of small beans or radish seeds. Radishes will sprout well, but the seeds and sprouts are very small. Seeds for sprouting can usually be found in health food stores and some grocery stores.

When to start
The sprouting activity is designed to take 5 days. To complete the sprouting sequence, it should be started on a Monday and completed on a Friday.

Soaking beans
Soak the beans overnight in a jar of water to prepare them for sprouting. Do not leave them in the water for more than 24 hours or they will start to decompose. Rinse the beans before putting them on a growing cloth.

Growing cloth
A flour-sacking dish towel makes an excellent growing cloth for the larger quantity of sprouts. A smaller cloth can be used for the 60–100 seeds needed for Activity K.3.5 PLANTS AND WATER.

Keeping records
The students draw what they see each day and tape the bean- sprout parts that they observe to the student page.

Parts of seeds
Though this activity is not a study of nomenclature, students are usually curious about what things are called. For names of parts see Fig. K.4.4.

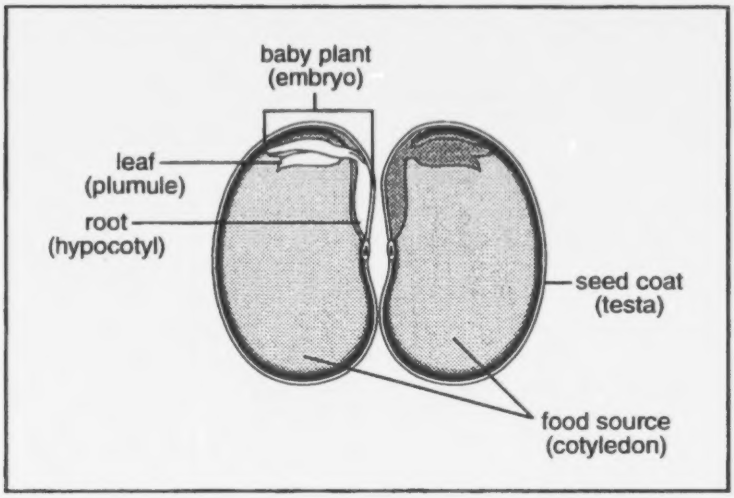
baby plant
(embryo)
leaf
(plumule)
root
(hypocotyl)
seed coat
(testa)
food source
(cotyledon)

Fig. K.4.4 Parts of a bean seed

Further growing of mung beans
It is very exciting to include mung beans as one of the food- producing plants to be grown in Activity K.4.6 GARDENING. At that time have the students predict what parts of the seed will come out of the ground. Keep all records on a chart about seed predictions.

STUDENT ROLES

Botanist
Farmer

MATERIALS

chart paper
lima beans
1/2 to 1 cup of mung beans or other seeds (small beans or radish seeds) for growing salad sprouts
2 flour-sacking dish towels
trays to hold cloths
quart jar
water source
tape
hand lenses
Student Page K.4.4 BEAN SPROUTS

PRODUCTS

Class chart of seed predictions
Completed Student Pages

PROCEDURES

1. **Begin the study of plant development by having the students open a soaked lima bean and identify the parts. Have them use hand lenses to observe small structures.**

   Help the students do the following:

   - Review the use of hand lenses.
   - Observe the outside of a seed and draw it.
     ✔ They will normally find a seed coat or thin outside covering of the seed.
   - Open a seed with a fingernail or toothpick and use a magnifying glass to observe it.
     ✔ They will find the embryo with its miniature root and leaf structures.
     ✔ In addition they will find two large, whitish starch sources that give the seed its shape.
   - Make drawings of the parts of the seed.
     ✔ Have them use Student Page 4.4.4A LIMA BEAN.
   - Tape the parts of the soaked seeds to the Student Page
   - Name the seed parts and label the lima bean. See Fig. K.4.4.
     ✔ The skin-like covering is called the *testa.*
     ✔ They should be able to find the *embryo* or baby plant with its root or *hypocotyl* and the leaf structure or *plumule.*
     ✔ In addition they will find the *cotyledons*, the large whitish food sources that give the seed its shape.
   - Put the pages with the attached seed parts in a plant press.

2. **Introduce the idea of growing bean sprouts. Start the study by examining dry seeds.**

Help the students do the following:
- Examine unsoaked bean seeds using hand lenses.
  ✔ By pulling away the dry outer coat, they can see the two halves of the seed and open the seed.
- Look for parts that look like ones they saw in the lima bean.
- On Student Page K.4.4B BEAN SPROUTS draw pictures of what they see and label them.
- Tape the seeds to the student page.

3. **Day 1. Prepare the seeds. Have the students put 1/2 cup of mung bean seeds in a jar of water. Allow the beans to soak overnight. Stress hand washing since sprouts will be eaten.**

4. **Day 2. Have the students examine the soaked bean seeds and prepare seeds for sprouting. Stress hand washing.**

Help the students do the following:
- Observe the outside of a seed and draw it.
- Compare the parts of the soaked mung bean with the parts they previously found in the lima bean.
- Make a drawing of the parts of the mung bean seed and label the parts.
- Tape the parts of the soaked seeds to the Student Page K.4.4B BEAN SPROUTS.

5. **Make a large (about 600 or more seeds) and a small (about 60–100 seeds) bean-sprout seed-roll. The larger roll will be used in the rest of this sequence. Starting on Day 3 the smaller roll will be used with Activity K.4.5 PLANTS AND WATER. Once again stress hand washing.**

- Wet two sacking dish towels by soaking them and squeezing out excess water.
- For Activity K.4.5 PLANTS AND WATER spread 60 to 100 seeds evenly down the middle of a wet flour-sacking dish towel, leaving several inches around the outside.
  ✔ Fold over the edges to keep the seed from spilling out.
  ✔ Loosely roll the cloth up.

- Spread the remaining 600 or more seeds down the middle of the second wet flour-sacking dish towel leaving several inches around the outside.
  ✔ Fold over the edges to keep the seed from spilling out.
  ✔ Loosely roll the towel up.

- Dampen the towels thoroughly and when they stop dripping place them on a tray.
  ✔ This will be the only time the batch of seed in the smaller cloth will be dampened.
  ✔ The large dish towel should be soaked once each day.
  ✔ *Do not* put water in the tray. This will drown the seeds.

6. **Discuss what is known so far about bean seeds.**

Ask such questions as these:

- What is the color of the outside of the dry seed?
  ✔ It will be the same as the color of the coat of the soaked seed.

- Can anyone point to a seed coat on your student page? What is it like?
  ✔ Get at such things as it is a very thin shell, skin, or wrapping—this is the *testa.*

- What did you find on the inside of the seed?
  ✔ With a hand lens they probably saw the *cotyledons*, the *embryo* with its *plumule* and *hypocotyl.*

- What might each of the inside parts become? Record the class chart about seed predictions.

7. **Day 3. Unroll a little of the large towel and have each of the students remove a bean for study. Once again stress hand washing.**

Have each student do the following:

- Observe the seed and draw what they see from the outside on Student Page K.4.4B BEAN SPROUTS.

- Open their seeds carefully and use a hand lens to observe the parts.

- Tape the seed parts to the student page and label them.

- Continue to soak the towel once daily and after it stops dripping, put in back in its tray.

8. **Discuss changes in the seed.**

   Ask such questions as these:
   - What does the seed look like now?
   - What do you think is coming out of the seed?
   - What do you think will happen to the seeds in the small cloth if we don't water them?
     ✔ Record predictions on the chart about seed predictions.
     ✔ Do not open the small cloth at this time.

9. **Start Activity K.4.5 PLANTS AND WATER with the seeds in the smaller cloth. Allow the cloth to dry out.**

10. **Day 4. Unroll a little more of the large cloth and have each of the students remove another bean for study. Stress hand washing since sprouts will be eaten.**

    Have the students do the following:
    - Observe the seed and draw what they see from the outside on Student Page K.4.4 BEAN SPROUTS.
    - Open their seeds carefully and use a hand lens to observe the parts.
    - Tape the seed parts to the student page and label them.
    - Continue to soak the towel.

11. **Discuss changes in the seed.**

    Ask such questions as these:
    - What does the seed look like now?
    - What do you think is coming out of the seed?
      ✔ Record predictions on the chart about seed predictions.

12. **Day 5. Unroll a little more of the towel and have each of the students remove another bean for study. Stress hand washing since the sprouts will be eaten.**

    Have each student do the following:
    - Observe the bean seed and draw what they see on Student Page K.4.4 BEAN SPROUTS.

- Open their seeds, observe the parts, tape the seed parts to the student page, and label them.

13. Ask the students questions about the seed right before it is eaten.

- What does the seed look like now?
- Were your predictions about the seed parts correct?

14. Proceed to Activity K.5.1 BEAN SPROUT SALAD.

EXTENSION

- Germinate other seeds such as alfalfa, wheat, radish, corn, or others for comparison
  ✔ Caution: DO NOT EAT sprouted seeds unless the sprouting seeds come from a health-food store and are intended for sprouting. Seeds intended for field and garden planting are often dipped in chemicals to ward off mold and insects.

DASH

BEAN SPROUTS
SP K.4.4

Name ____________________

Date ____________________

DAY	DATE	SEED	DRAW WHAT YOU SEE
1			
2			
3			
4			
5			

2.4.16 TREE PLANTING

OBJECTIVES

The students
- Plant a tree with a DASH 5 class.
- Discuss Arbor Day or Earth Day.
- Observe a tree mature over time.
- Identify trees as a renewable resource.

BACKGROUND

In this activity DASH 5 students plant a pine tree with DASH 2 students to replace the one that the DASH 5 students have harvested. This newly planted tree will be harvested three years later before the December holidays by these same DASH 2 students when they are in DASH 5. The planting of the pine tree symbolizes the passing on of a heritage to another class and replenishes a resource that has been used.

Coordination

This activity should be coordinated between DASH 2 and DASH 5 classes. An ideal time for the planting of the tree is Arbor Day or Earth Day. Arbor Day usually occurs on the last Friday of April. The tree can be purchased, but preferably it is grown from seeds by the DASH 5 students. The older DASH 5 students should invite the DASH 2 students to participate in the planting. Ceremonial speeches can be given by representatives of each class. A time capsule can be buried near the tree and refreshments can be served.

Records

Students record the height of the tree and make a shadow profile of it on chart paper. The shadow profile can be drawn in the classroom before the tree is taken outside. It is suggested that information on the height and shadow profile be kept in the library to use for comparison when the tree is harvested in three years. If there is no DASH 5 program, the DASH 2 students should plant a tree on their own and harvest it when they become DASH 5 students. Individual student records are kept in their Science Record Books.

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STUDENT ROLES

Tree planter
Forester

MATERIALS

tree
shovels
chart paper
Student Page 2.4.16 HISTORY OF A TREE

PRODUCTS

Shadow profile of a tree
Completed Student Pages

PROCEDURES

1. **An invitation should be received from a DASH 5 class to attend an Arbor Day or Earth Day tree planting.**

   Ask such questions as these:
   - What is Arbor Day or Earth Day?
   - How did this day originate?
   - Why is this day important?
   - Why do you think DASH 5 students are planting a tree for us?
   - What is meant by a renewable resource?
     ✔ This is a question that can be asked of the DASH 5 representatives.

2. **Have the students plan for the Arbor Day or Earth Day ceremony.**

   Help them
   - Write a response to the DASH 5 class.
   - Plan for a thank-you speech, refreshments, and so forth.
   - Practice drawing a shadow profile.
     ✔ See Figure 2.4.16.

3. **Have the class participate in the Arbor Day or Earth Day ceremony.**

Have the students
- Draw a shadow profile of the tree to be planted.
- Measure and record the height of the tree on Student Page 2.4.16 HISTORY OF A TREE.
  ✔ This student page should be kept in the materials passed on to DASH 3 teachers.
- File the shadow profile and height measurement in the library for comparison in DASH 5 when the tree is harvested.
- Give a thank-you speech to the DASH 5 Students.

ILLUSTRATION

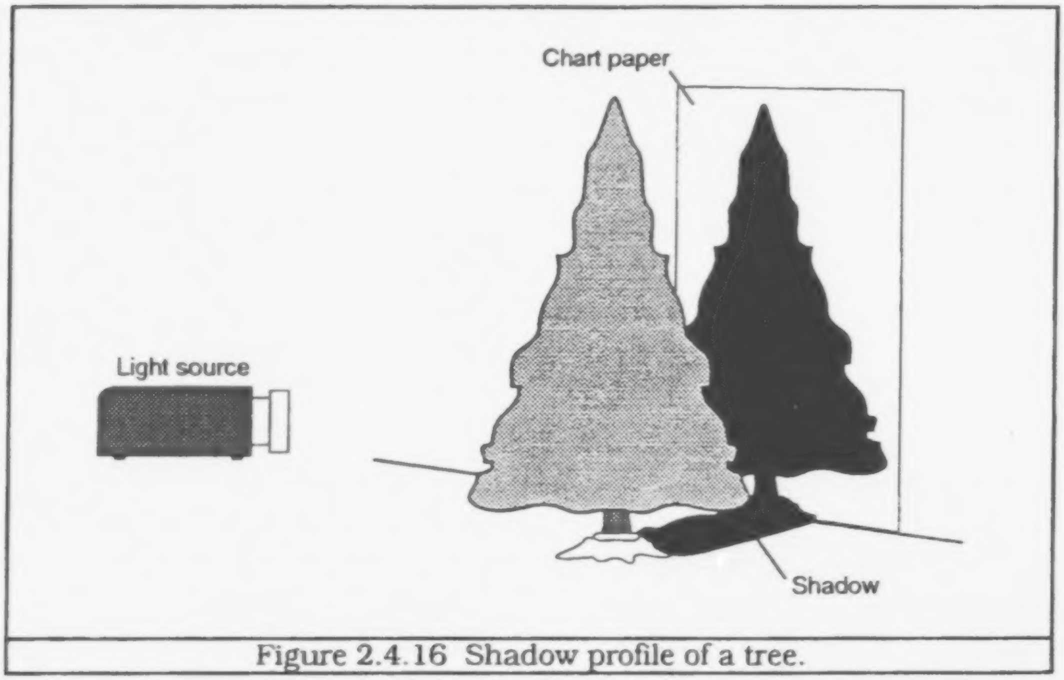

Figure 2.4.16 Shadow profile of a tree.

DASH

HISTORY OF A TREE
SP 2.4.16

Name: ____________________

Date: ____________________

Kind of tree:	
Date planted:	Location:

DATE	HEIGHT (cm)	OBSERVATIONS

2.4.1 SOIL

OBJECTIVES

The students
- Collect soil samples.
- Investigate soil with a magnifying glass.
- Invent a method of drying soil.
- Invent a device to sort components by particle size.
- Measure volume and mass of soil components.

BACKGROUND

This activity follows Activities 2.10.3 THE BALANCE and 2.10.5 MEASURING VOLUME.

In SOIL the students begin their investigation of soil. First they devise a way to dry the soil without using a stove. Sun drying is suggested though students may have other ideas. Spreading the soil on a tray and breaking up large pieces will speed the process. The students then separate the soil into its different components by sifting.

Sieves

Sieves with different-sized holes can be made by using various sizes of nails and aluminum pie or cake pans. A hammer may be useful but be sure to protect the surface under the pans. Standardize the sieves by the diameter of the nails used to make the holes.

STUDENT ROLE

Agronomist

MATERIALS

chart paper
soil
half-pint milk cartons for soil samples
trowels (shovels)
magnifying glasses

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aluminum pie or cake pans (4 per group)
aluminum foil
nails (1 set per group)
  three-penny (small)
  eight-penny box nails (medium)
  twelve-penny box nails (large)
hammers (optional)
wood to pound on (if hammers are used
newspaper
balances from Activity 2.10.3 THE BALANCE
graduated containers from Activity 2.10.5 MEASURING VOLUME
goggles
Student Page 2.4.1 SOIL

PRODUCTS

Concept map about soil
Completed Student Pages

PROCEDURES

1. **Help the class make a concept map about soil. Announce that they are going to study soil.**

   Ask such questions as these:
   - What do you know about soil?
   - How is soil used?
   - What do you think soil is made of?
   - Are soil, mud, and sand the same thing?
   - Are soil and dirt the same thing?
     ✔ This question is likely to stir up quite a debate. Encourage the students to research their views. There is not complete agreement in the scientific community so there is no definitive answer to this question—and many others in science. This is the nature of science.

2. **Have the students work in groups and go outside to get two half-pint samples of soil from the same place. Set aside one sample for Activity 2.4.3 SOIL AND PLANTS. Have different groups get samples from various places. Alternately have the students bring the samples from home.**

3. **Have the students investigate the soil samples with magnifying glasses.**

   Have them
   - Pour one of the two soil samples onto newspaper.
   - List the kinds of things they find in the samples.
   - Inspect, identify, and then return any living organisms to the places they were found.
   - Report findings on Student Page 2.4.1 SOIL.
   - Add any new information to the concept map about soil.

4. **Have the students invent a way of drying soil if it is moist. Explain that to study the soil further you must invent a way to dry it. Only natural heat sources are to be used.**

   Ask such questions as these:
   - How could you dry your sample if you can't use a stove?
   - Do you know any natural heat source?
   - If you have two samples of soil the same size and roll one into a ball and place it on your hand and spread the other on your hand, which would dry more quickly?
     ✔ Work for the idea that the spread-out soil will dry more quickly. Have someone try it and see,
   - What might this tell you about drying soil quickly?
     ✔ Work for the idea of spreading soil thinly to dry it more quickly.
   - What happens to the soil when it is dry?
     ✔ Work for the idea that it breaks up into small pieces.

5. **Once the soil is dried have the students study their samples again. Have the students invent ways to granulate chunks of soil and to separate dry soil by particle size.**

   Ask such questions as these:
   - What different kinds of things did you find?
   - Are there chunks of dried soil?

- How could you break these chunks into smaller pieces?
  ✔ Work for such things a rubbing them together, putting them into a sock and hitting the sock against the floor.
- How could you separate all of the particles that are about the same size into different piles?
  ✔ If students don't come up with an idea, show the students a toy sand sifter. Ask how the device works.
- How could you make such a device?
- How can you make holes of different sizes?
- How can you make all the holes in a sieves the same size?
  ✔ Help them *only as needed* to make 3 sieves with different-sized holes. See suggested nail sizes.

6. **Have the students measure out approximately 125 mL or 1/2 cup of dry soil. Use their graduates from Activity 2.10.5 MEASURING VOLUME. Have them sort and measure the mass and volume of soil particles of different sizes.**

   Help them
   - Weigh their sample before beginning to sift. Record the mass and volume of the soil sample on SP 2.4.1 SOIL.
   - Sort the particles by sifting or other methods.
   - Weigh the amount of material of each different particle size using their balances. Record their data on Student Page 2.4.1 SOIL.
   - Measure the volume of the amount of material of each different particle size using their graduates. Record their data on the Student Page 2.4.1 SOIL.

7. **Help the students make some generalizations about soil.**

   Ask such questions as these:
   - What does soil seem to be made of?
   - Do all samples of soil contain the same things? Explain.
   - Are there the same amounts of different-sized particles in various samples of soil?

- Is the sum of the masses of the different sized particles equal to the mass of your starting sample? Volumes? If not, what might have happened?
- What information should be added to or modified on the concept map about soils?

EXTENSIONS

- Set up an agronomist center where students can investigate, measure, and record the contents of additional soil samples they collect.
- Create a bulletin board display by attaching small soil samples in baggies to a neighborhood map to identify where they were collected.

DASH

SOIL
SP 2.4.1

Name: ______________________

Date: ______________________

Where did you get your soil?

Observations:

MASS

Unit __________

Total Sample	Biggest	Medium Big	Medium Small	Smallest

VOLUME

Unit __________

Total Sample	Biggest	Medium Big	Medium Small	Smallest

2.4.2 MAKING SOIL

OBJECTIVES

The students
- Hypothesize about how rocks become soil.
- Crush rocks into soil size particles.
- Make soil from their crushed rock.
- Summarize and speculate about soil formation.

BACKGROUND

The students try to make soil from rock after they have investigated the contents of the soil samples collected in Activity 2.4.1 SOIL. Three methods are suggested. Sand can be pulverized with a hammer, rocks can be crushed with a stamp mill, and weathered or fragile rocks can be broken up by rubbing them together.

Stamp Mill
Make a stamp mill for crushing rock or borrow one from another DASH 2 or DASH 4 teacher if one is not already in the classroom. See figure 2.4.2 for construction. Caution the students not to try breaking the rocks with hammers.

Eye Protection
Eyes should be protected with goggles during this activity. Eyes can also be protected with student made face shields. This is an opportunity for the DASH 5 students to help in making shields. See Activity 2.10.6 SAFETY EQUIPMENT.

Measuring Volume and Mass
Use the procedures from Activity 2.4.1 SOIL to determine the volume and mass of the particles that are produced. The proportions of different sized particles found in Activity 2.4.1 SOIL can be used as a soil recipe.

STUDENT ROLE

Agronomist

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MATERIALS

small rocks to be crushed
large rocks to be dropped on each other
weathered rocks or sand (decomposing granite, sandstone, volcanic tuff)
stamp mill rock crusher
  30 cm (1 ft) of metal pipe 1 and 1/2-inch in diameter
  1 metal cap 1-1/2 inch in diameter
  1 meter (3 ft) of metal pipe 3/4-inch in diameter
  1 metal cap 3/4 inch in diameter
hammer for sand pulverizing only
balance
goggles
graduated containers from Activity 2.10.5 MEASURING VOLUME
balances from Activity 2.10.3 THE BALANCE
sieves from Activity 2.4.1 SOIL
newspaper
thick metal surface for pulverizing sand (a thick concrete surface can be used if hammer marks are of no concern)
Student Page 2.4.2 MAKING SOIL

PRODUCTS

Student-made soil
Completed Student Pages

PROCEDURES

1. **Review the concept map about soil with the class and introduce the problem of making soil.**

   Ask such questions as these:
   - What does soil mostly seem to be made of?
     ✔ Review the contents of the soil they have just analyzed.

   - Where do you think these particles came from originally?
     ✔ Work to the idea that they probably came from rock because they look like little rocks and rocks can be broken up to look like these particles.

   - Do you think you could make soil from rocks? What would you need to do this?

- What danger is there in using a hammer to break up rocks?
  ✔ Get at the idea that rocks can fly when hit with a hammer. Show them the stamp mill and have a student demonstrate how it crushes small rocks.

- Why should you wear goggles or face protectors?

- What else did you find in the soil you analyzed in Activity 2.4.1 SOIL?

2. **Have each group come up with a soil recipe similar to one they analyzed in Activity 2.4.1 SOIL and record it on Student Page 2.4.2 MAKING SOIL. The total volume should be about 125 mL or one half cup of soil.**

Have them include
- Rock particle sizes and proportions.

- Any other ingredients from their analysis that they may wish to add and their proportions.
  ✔ Do *not* add fertilizers since they are ingredients that will not have been seen in the original analysis of soil. The role of fertilizers and chemical nutrients in soil will be dealt with in later DASH work.

3 **Have the students crush small rocks and pulverize sand.**

Help them
- Discover how to pulverize sand using a hammer.

- Discover how to use the stamp mill to crush small rocks.

- Discover that rubbing weathered rocks together breaks them up.

- Collect all pulverized materials after all team members have had a chance to work.

4. **Have student groups sort and measure the amount of soil particles of different sizes they will need to make 125 mL of artificial soil.**

Help them
- Sort the particles by sifting or other methods.

- Weigh or measure the amount of each particle size they put together.
  ✔ Save the sample for Activity 2.4.3 SOIL AND PLANTS.
- Record their data on Student Page 2.4.2 MAKING SOIL.

6. Summarize and speculate about soil formation with the class.

Ask the students such questions as these:

- Have you made the same kind of soil that you found outside?
- How was the soil you made similar to and different from the soil you found outside in Activity 2.4.1 SOIL?
  ✔ Compare the proportions.
- How might big rocks on top of mountains or in streams be made into smaller rocks?
  ✔ Get at the idea that rocks can fall off mountains and rub against each other in streams. You may want to drop larger rocks on each other. Be careful to keep feet out of the way and protect eyes.
- How could big rocks help pulverize sand in streams?
  ✔ Test out ideas.
- Do you have any additions for the concept map about soil?

EXTENSION

- Visit a stream bed or rock slide and look at rocks, sand, and silt for clues to natural soil formation.

ILLUSTRATION

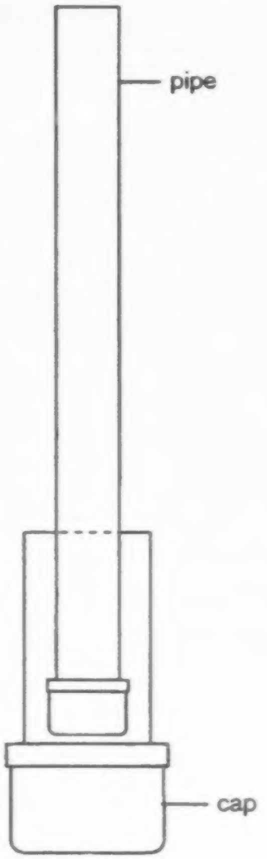

Figure 2.4.2 Stamp mill rock crusher.

MAKING SOIL
SP 2.4.2

Name: ____________________

Date: ____________________

SOIL RECIPE		
INGREDIENT	AMOUNT	UNIT

SOIL	MASS/WEIGHT Unit:	VOLUME Unit:
Biggest Pieces		
Medium Big		
Medium Smalll		
Smallest Pieces		

1.10.7 BUBBLES IN WATER

OBJECTIVES

Students
- Predict the behavior of air in water.
- Observe the behavior of air in water.
- Observe the behavior of containers in water.

BACKGROUND

BUBBLES IN WATER is usually followed by Activities 1.10.8 BUBBLES IN AIR, and 1.10.9 BUILDING WITH AIR. BUBBLES IN WATER is a semi-directed activity designed to study containers and bubbles in water. It shows that a gas can be captured, confined, controlled, and quantified.

Containers

The activity is done in an aquarium, a glass gallon jar, or a clear plastic bag viewing box. A viewing box is made by cutting windows in the side of a cardboard box, lining the box with clear plastic, and filling it with water.

STUDENT ROLE

Experimenter

MATERIALS

aquariums, gallon jar, or cardboard viewing boxes
buckets
tubing or straws
graduated jars
mops
newspapers
Student Page 1.10.5 BUBBLES IN WATER

PRODUCT

Class chart bubbles in water
Completed Student Pages

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PROCEDURES

1. **Have students predict what they think a bubble of air will do and what it will look like in water. Record the predictions on Class chart Bubbles In Water. Have students test their predictions by blowing bubbles into water. Record observations on the chart.**

   Ask such questions as these:
   - Where did the bubbles go?
   - Did they go straight?
   - What is the shape of small bubbles?
   - What is the shape of large bubbles?
   - Do bubbles change their shape? If so, how?
   - Do little bubbles act the same as big bubbles?
   - Do some bubbles seem to move faster than others?
   - What kinds of bubbles move fastest? How did you test this?
   - What happens when you have a whole lot of bubbles at one time?
   - What questions do you want to find out about bubbles? Try to find answers.

2. **Have students share their questions and answers. Add this information to the class chart bubbles in water.**

3. **Have students put a jar under water, mouth *up*. Have them lift it out of the water to find out what happens and how it feels.**

   Ask such questions as these:
   - How does the jar feel as it gets further and further out of the water?
   - How much water are you bringing up?

- What happens when you blow bubbles of air into the mouth of a submerged jar when its mouth is turned up.

4. **Have students put a jar *upside* down in water. Have them lift it out of the water to find what happens and how it feels.**

   Ask such questions as these:
   - How does the jar feel as it gets further and further out of the water?
   - How much water are you bringing up?
   - How is this experiment different from the one in which we had the mouth of the jar turned up? How is it similar?
   - What happens when you blow bubbles into the mouth of the submerged jar when its mouth is down?

5. **Have students experiment freely with bubbles and air to answer their own questions. Use Student Page 1.10.5 BUBBLES IN WATER to record their ideas. Do not help them with questions unless they run out of ideas.**

   Questions such as the following may be used.
   - What happens to the air in the jar?
   - Do bubbles coming out of the water in the jar seem to leave the aquarium?
   - How does the jar partly filled with water feel as it gets further and further out of the water?
   - You can put air into a jar underwater. Can you take it out?
   - Can you pour water from one container to another under water?

6. **Have students report on their experimentation.**

   Ask such questions as these:
   - Do our observations help us think about air as being something? If so how?
   - How might we measure the amount of air underwater.

EXTENSION

- Create a Bubbles in water center and have the students continue to explore and report what they find.

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DASH

BUBBLES IN WATER
SP 1.10.7

Name: ____________________

Date: ____________________

BUBBLE QUESTIONS	WHAT DID YOU DO?

1.10.8 BUBBLES IN AIR

OBJECTIVES

The students
- Invent ways of making bubbles of different sizes.
- Observe bubbles in air.
- Compare bubbles in air and bubbles in water.

BACKGROUND

In this activity students compare the shapes, movement, and other properties of soap bubbles in air with air bubbles in water. This is an open-ended inquiry with the questions coming from students.

This is an outdoor activity.

For bubble solution, mix
- 1 cup Dawn or Joy liquid detergent
- 10 cups water
- 1/4 cup glycerin or corn syrup (Both are optional.)

CAUTION: Some people are allergic to glycerin and/or detergent. Either may cause eye or skin irritation.

Bubbles do best in high humidity. Just after a rain or early morning are excellent times. Add a bit more water to the solution if results are not satisfactory.

STUDENT ROLES

Experimenter
Inventor

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MATERIALS

chart paper
markers
Styrofoam cups
straws
string
Styrofoam plates or meat trays (Holes can be made for bubble making.)
soft drink plastic holders for 6-packs
dish pan for solution
light corn syrup or glycerin
Dawn or Joy detergent
Student Page 1.10.8 BUBBLES

PRODUCTS

Class chart bubbles in air
Bubble makers
Completed Student Pages

PROCEDURES

1. **Have students invent bubble makers and prepare the bubble solution.**

   Bubble makers can be made from Styrofoam cups, plates and trays, straws, straws and string, and plastic 6-pack holders. Use the Inventor's Box to stimulate ideas.

   Demonstrate the use of bubble makers.

2. **Have students suggest things to observe and questions to answer.**

   Make a Class Chart BUBBLES IN AIR.

3. **Have students investigate bubbles of air in air.**

   This is an activity best done outdoors.

4. **Record student observations of soap bubbles on the class chart bubbles in air. Compare observations with bubbles in ware (Act. 1.10.7). Record comparisons on Student Page 1.10.8 BUBBLES or another class chart.**

Some suggested questions are
- How were bubbles in air different from bubbles in water?
- How were bubbles in air similar to bubbles in water?
- Which were bigger?
- Which were smaller?
- Did they float the same way?
- When did bubbles in air seem to float up high?
- What other observations did you make?
- What questions did you ask and what answers did you find?

DASH

BUBBLES
SP 1.10.8

Name: ______________________

Date: ______________________

PROPERTY	BUBBLES IN WATER	BUBBLES IN AIR

2.4.7 MOVING WATER

OBJECTIVES

The students
- Invent ways to move water from one place to another.
- Discover ways to regulate the flow of water.
- Discover how a siphon works.

BACKGROUND

MOVING WATER is a *wet activity* and should be done on an uncarpeted floor, outdoors, or some other place where water can be spilled without concern. This activity is designed to explore moving water from one place to another using gravity. It is followed by 2.4.8 MOVING WATER WITH PUMPS. Use the Inventor's Box to hold a wide variety of possibly useful items.

Problems

There are four major problems for invention with additional challenges. The students are given the opportunity to explore freely each within the bounds of safety and courtesy. Present all work as a research.

Encourage invention. Begin the activity as an open inquiry. Use Socratic questioning to give the students clues if they get frustrated. Have the students share their discoveries. Demonstrate how to assemble equipment *only* as a last resort. For equipment setups see Figure 2.4.7(1–4).

Approach

This is a teacher facilitated sequence. Present new problems and challenges as student groups solve earlier ones. Each group should try to find solutions to the four numbered problems and some of the challenges. Not all groups need confront all challenges. Problem 4 will prove to be a challenge. It is illustrated in Figure 2.4.7(4) where groups are to try to get water to flow uphill. The solution to this problem is found in Activity 2.4.8 MOVING WATER WITH PUMPS. The diagrams in Figures 2.4.7(1–4) can be shown on an overhead projector or drawn on the board for students to clarify the problems without destroying the potential for invention.

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Water Sources
Plastic bottles are excellent containers. They can be cut in half. The tops can be used to deliver water and the bottoms can be used to receive water. Cutting should be in the control of the teacher.

Stoppers
Tubing can be secured in the opening of a bottle by wrapping the tubing with cloth and forcing it into the opening. This technique, though drippy, can accommodate several tubes and is one that the students can use at home.

Alternatives. Holes can be drilled in bottle caps a little smaller than the tubing. When tubing is pushed into the hole, little or no water will leak. Caps can be screwed onto plastic bottles. This is the method shown in the diagrams. Standard corks or rubber stoppers can be bored and metal, plastic, or glass connectors can be used to hold the tubing. The students will invent numerous systems when duct tape, sponge pieces, and floral clay are available.

Siphon
Water will flow from one container to another through a hose or tubing that carries water *over a hill* when two requirements are met. First, the level of the water in the source must be higher than the level of the water outlet or receiving container. Second, the hose must be completely filled with water at all times. See Figure 2.4.7(3).Such a system is called a *siphon*. A siphon is particularly convenient for emptying aquariums. See Activity 2.3.1 THE CLASSROOM AQUARIUM.

Filling the Tubing
Completely fill a piece of tubing or a hose by putting it in a bucket of water. Let the air escape from the tubing. Place fingers over the ends to prevent the water from running out and put one end of the tubing in the source container and the other in the receiving container. For sanitation reasons caution the students not to suck on the tubing.

STUDENT ROLE

Hydrology engineer

MATERIALS

tin cans and other plastic containers
plastic bottles cut in half (use both tops and bottoms)
plastic bottles (uncut)
caps for bottles (these may be predrilled to hold tubing)

clear plastic tubing (multiple diameters)
plastic straws
cork borer (optional)
stoppers (Styrofoam, cork, rubber) (optional)
rigid connecting tubing (plastic, metal, glass—*use caution*) (optional)
rags for stoppers
sponge pieces for stoppers
buckets
clothespins
paper clips
wire coat hangers
string
floral clay
duct tape
hand drill and bits
razor blade knife or universal scissors to cut bottles (*For teacher use only*)
Student Page 2.4.7 MOVING WATER

PRODUCTS

Invented water systems
Completed Student Pages

PROCEDURES

1. **Introduce the inquiry to the students by discussing the need to control the movement of water from one place to another. Explain that they will be given a series of engineering problems to solve. Go over safety and other issues concerning leaky systems.**

2. **Present Problem 1: Invent a system to move water from one container to another container one meter away. See Figure 2.4.7(1). This will involve a tube and raising the water source above the container. Demonstrate one way of connecting tubing to bottles if necessary.**

   Some additional challenges:
   - Can you invent a way to fill a container slowly while you are one meter away from it?
     ✔ This will probably involve inventing a way to cut down the flow.

- Can you invent a way to fill a container quickly?
  ✔ This will probably involve such things as holding the source container higher, increasing the number of tubes, and changing tube size.

3. **Present Problem 2: Invent a way of delivering water at the same time to two different places that are each one meter away from the water-source container. See Figure 2.4.7(2). This will involve at least 2 tubes and raising the water source above the container.**

   Some additional challenges:
   - Can you invent a way to slowly fill both containers at the same time while you are somewhere else?

   - Can you invent a way to quickly fill one containers while slowly filling the other.

   - Can you invent a way to fill one container, stop the water, and then fill the other container?
     ✔ This will probably involve inventing a valve system, possibly using clothespins or simply pinching the tube.

4. **Present Problem 3: Invent a way to get water to flow from one container to another over a hill. See Figure 2.4.7(3) and the Background on the siphon.**

   Additional challenge:
   - How high a hill can you get the water to flow over?
     ✔ The height will be limited by the available equipment.
     ✔ Name this special kind of system a *siphon*.

5. **Have the students explore freely, creating and solving their own problems.**

   Suggest some additional challenges:
   - Can you keep a system with one container delivering water continuously all day without adding water?
     ✔ Solutions might include drip systems, very large source tanks, and so forth.

   - How can you bring a hose over the edge of a bucket without pinching off the water?
     ✔ A solution might be taping a hose to the more gentle bend of a wire.

- Can you deliver water across the room to the sink by routing it along the floor? If so, how?
  ✔ They will find that they can if the water level in the source is higher than the sink.

- Can you deliver water to the other side to the room by routing it across the ceiling? If so how?
  ✔ They will find that they can if the water level in the source is higher than the sink and they have a filled siphon tube.

- Can you deliver water to another container when the water levels in the two containers are the same height? If so, how?
  ✔ Water will not flow.

- Can you get water to flow through a siphon while keeping the water in the containers the same height? If so, how?
  ✔ Water will not flow.

6. **Present Problem 4: Invent a way to get water to flow only uphill. Emphasize that this is not up hill and down as with a siphon. See Figure 2.4.7(4).**

   Help them
   - Try such things as adding more water to the lower container, starting a siphon and carrying it up before it is released, and so forth.
     ✔ Water will not flow uphill. The students will find that water will flow only from the higher to a lower level, not the reverse.

7. **Have the student groups describe and demonstrate what they have done to solve the problems and challenges. Have them record their group solutions on Student Page 2.4.7 MOVING WATER.**

   Some suggested questions are:
   - What did you find in your water experiments?

   - When using a siphon, was anyone able to get water to go to a higher level than the water source container?
     ✔ Yes, but it always had to come down through a hose and the receiver always had to be lower than the sources.

   - Was anyone able to get water to flow uphill only?
     ✔ The expected answer is no. If they answer yes, have them demonstrate.

- Do streams and rivers flow uphill, downhill, or both?
  ✔ The expected answer is downhill only.

- How do we get water into water tanks and mountain reservoirs?
  ✔ This question leads to the next Activity 2.4.8 MOVING WATER WITH PUMPS.

EXTENSION

- Hold a follow-up moving-water exploration to allow students to test new solutions to the problems presented in this activity and other related problems of their own invention.

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ILLUSTRATIONS

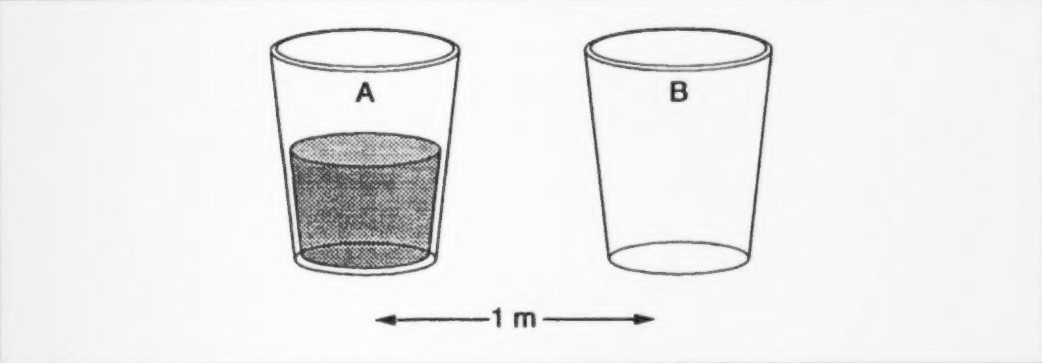

Figure 2.4.7(1) Problem 1.
Move water from container *A* to container *B*.

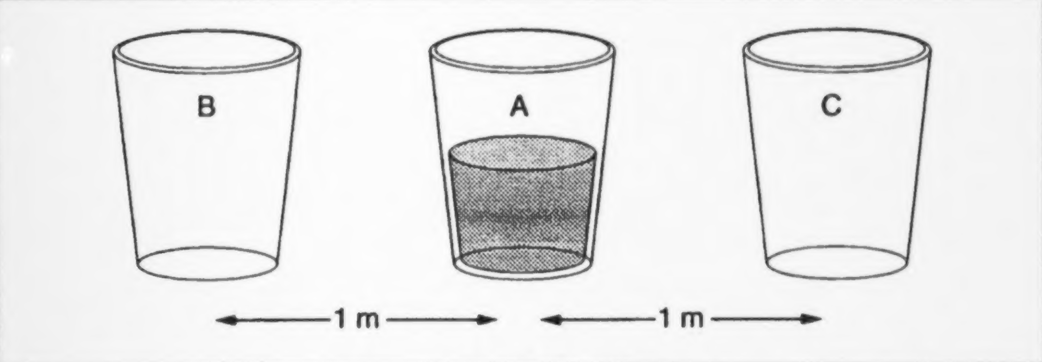

Figure 2.4.7(2) Problem 2.
Move water from container *A* to containers *B* and *C*.

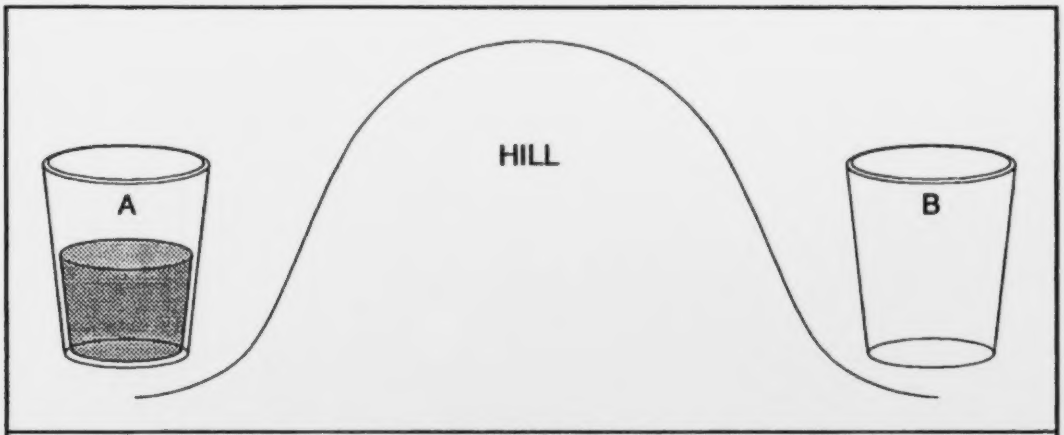

Figure 2.4.7(3) Problem 3.
Move water from container *A* over a hill to container *B*.

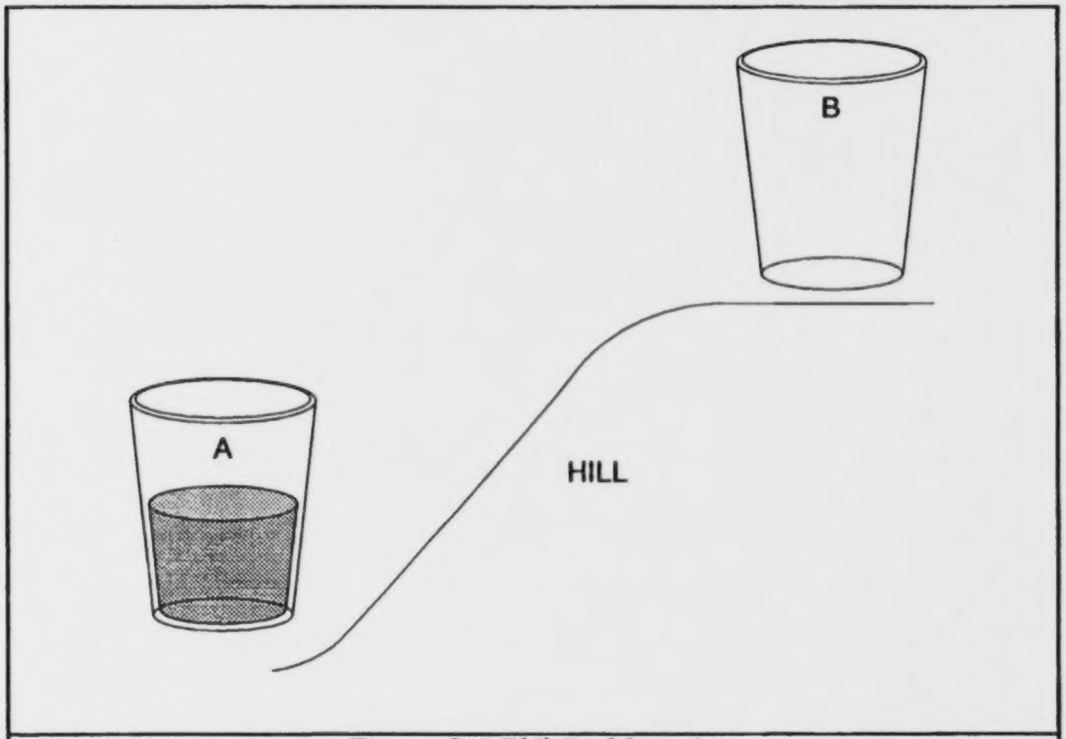

Figure 2.4.7(4) Problem 4.
Move water from container *A* up a hill to container *B*.

DASH

MOVING WATER SP 2.4.7

Name: ____________________

Date: ____________________

Group:
Problem: ____________________
Show how you solved the problem.

2.4.8 MOVING WATER WITH PUMPS

OBJECTIVES

The students
- Make a syringe-type pump.
- Observe that pumps can push or pull water uphill.

BACKGROUND

MOVING WATER WITH PUMPS is a *wet* activity and should be done on an uncarpeted floor, outdoors, or some other place where water can be spilled without concern. This activity follows 2.4.7 MOVING WATER and is designed to explore moving water from one place to another using a syringe-type pump. Use the Inventor's Box to hold a wide variety of possibly useful items.

Syringe Pump

Make a syringe-type pump from 2 plastic bottles of slightly different sizes. Cut out the bottom of the larger bottle to act as the barrel of the pump. Wrap the smaller plastic bottle with duct tape to make a snug fitting piston loose enough to be easily push backwards and forwards. A more air tight seal can be made by greasing the tape on the piston with petroleum jelly. Attach tubing to the bottle cap opening on the barrel. See Figure 2.4.8.

Stoppers

Tubing can be secured in the opening of a bottle by wrapping the tubing with cloth or a piece of sponge and packing it tightly into the opening. Though drippy, this method can accommodate several tubes and is one that the students can use at home. This method will probably work best here. For alternatives see Activity 2.4.7 MOVING WATER.

Problems

There are four problems for invention with several challenges. The students are given the opportunity to explore each problem freely within the bounds of safety and courtesy. Present this as a research activity.

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Approach

Again this is a teacher facilitated sequence of investigations like Activity 2.4.7 MOVING WATER. A demonstration pump should be assembled with the students. The students need to practice using the pump, getting a feel for the way it works. The pump can be used to push water up a hill and to pull it up a hill. How pumps do this is part of the invention.

Continuous Operating Pump.

The pump need not be disconnected from the system to fill and empty it if two tubes are put into the nozzle of the pump. By closing off the output tube through which the water is expelled water can be drawn into the pump through the input tube. Then, when the pump is full, close the input tube, open the output tube, and expel the water through the output tube. Clothespins and binder clamps make good valves. See Procedure 7.

STUDENT ROLE

Hydrology engineer

MATERIALS

tin cans and other plastic containers
plastic bottles
caps for bottles (these may be predrilled to hold tubing)
clear plastic tubing (multiple diameters)
plastic straws
cork borer (optional)
stoppers (Styrofoam, cork, rubber) (optional)
rigid connecting tubing (plastic, metal, glass—*use caution*) (optional)
rags for stoppers
sponge pieces for stoppers
buckets
clothespins
binder clips
paper clips
wire coat hangers
string
floral clay
duct tape
petroleum jelly
hand drill and bits
razor blade knife or universal scissors to cut bottles (*For teacher use only*)
Student Page 2.4.8 MOVING WATER WITH PUMPS

PRODUCTS

Invented pump systems
Completed Student Pages

PROCEDURES

1. **Have the students review the work done in the Activity 2.4.7 MOVING WATER.**

   Ask such questions as these:
   - When using the siphon, was anyone able to get the water to a container at a higher level than the water source?
     ✔ If any students say yes, have them demonstrate how they got the siphon to go uphill. Their invention or failure will establish the nature of the problem confronted here, which is how to get water to move uphill.

   - Do rivers and streams flow uphill or downhill?

   - How do we get water up to city water tanks or mountain reservoirs?
     ✔ Lead the discussion around to the need for a device to push or pull water up to the tank or reservoir. Call such a device a *pump*.

2. **Introduce the inquiry to the students by discussing ways to move water up a hill. Explain that they will be given a series of engineering problems to solve. Review safety and other issues concerning leaky systems.**

3. **Demonstrate the construction of a pump. Have each group make one and encourage modifications. See Figure 2.4.8.**

4. **Present Problem 1: Invent ways to fill the pump without pouring water into it and then expelling it.**

   Have student groups
   - Test to see that the piston moves back and forth freely in the barrel.

   - Attach a plastic hose or tubing to the pump and invent a way to draw water into the barrel.

- Point the hose into a container and invent a way to expel the water.

- Explore how the pump works to take up and expel water.

5. **Present Problem 2: Invent a way to get pumps to push water as high as possible.**

   Have each student group
   - Invent their own system.
     ✔ Anticipate that some students will shoot the water into the air, others may use tubes, still others may use combinations of these and other ideas. Insist that they take precautions not to get other researchers wet and clean up their spills.

   - Demonstrate their system and tell how it works.

   - Discuss which of all the systems allowed them to get the water the highest.

   - Discuss which of all the systems gave them the greatest ability to control the water that was pushed up.
     ✔ Work for the idea that the hose gives them more control as to where the water will go, such as around corners.

6. **Present Problem 3: Invent a way to use a pump to pull water up a hill as far as possible.**

   Have each student group
   - Invent their own system.

   - Demonstrate their system and tell how it works.

   - Discuss which of all the systems allowed them to get the water the highest. Why?

   - Discuss which system gave them the greatest ability to control the water that was pulled up.

7. **Present Problem 4: Invent a two tube pump system that pushes or pulls water up to a tank or reservoir and empties its contents without being disconnected. See Background.**

8. **Present some additional challenge inventions to the students.**

- Invent a pump system that allows one to move water higher than it was pushed in Problem 2.
  ✓ This can be done by a pump that first draws water to a certain height then pushes it higher.

9. **Have the students record group inventions on Student Page 2.4.8 MOVING WATER WITH PUMPS.**

10. **Have the students demonstrate their systems and tell how they work. Discuss which systems work best and what is meant by best.**

11. **Have the students explore freely, asking their own questions and finding their own answers.**

    Ask such questions as these:
    - How might you take more water into your pump each minute with your present system?
    - Is it harder to push the water through a small hole or a large hole?

EXTENSION

- Have the students research water pumps and make models of them.

ILLUSTRATION

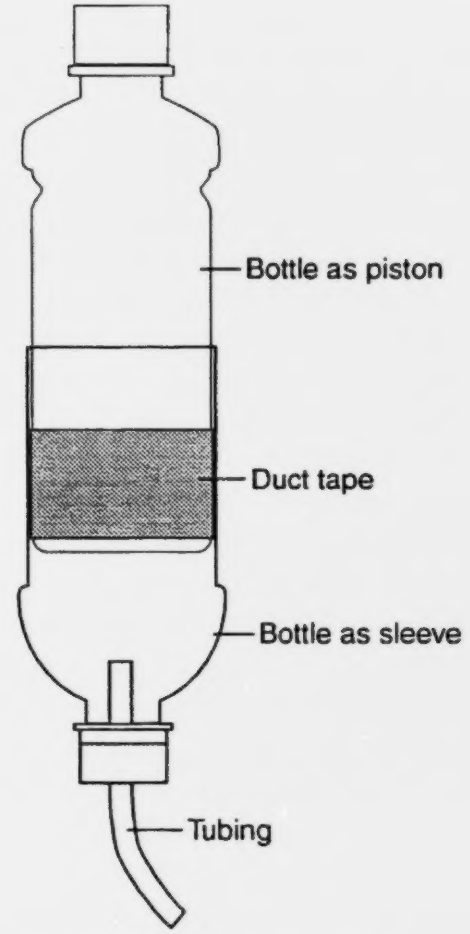
Bottle as piston
Duct tape
Bottle as sleeve
Tubing

Figure 2.4.8 Syringe-type pump.

DASH

MOVING WATER WITH PUMPS
SP 2.4.8

Name: ______________________

Date: ______________________

Group:

Problem: ______________________

Show your solution to the problem.

1.10.3 TESTING FOR WATER

OBJECTIVES

The students
- Test things for the presence of water using cobalt chloride paper.
- Observe that water can be driven out of things as a vapor.
- Observe that water is in many things around us.
- Observe that water is present in all living things.

BACKGROUND

This activity introduces the study of water. It is built around an ongoing inventory. Students are to find how many different things contain water.

Students will use cobalt chloride paper to test for water. Blue cobalt chloride paper touched to water turns red. When it is dried in the hot sun or gently warmed over a heat source, it turns back to its original blue color for reuse. Tiny pieces of the paper work well.

To make cobalt chloride paper, dissolve 10g of cobalt chloride in 100 ml of water. Saturate absorbent paper (filter paper, paper towel, etc.) in the solution. Dry the paper in the sun or a slightly warm oven. Cut into strips and store in an airtight jar.

Caution: Cobalt chloride solution is toxic if ingested. It may irritate eyes, skin, and respiratory system. Wash hands after handling.

Water can be removed from many substances. Put the substance in a Pyrex container and heat it on a hot plate. Collect the water on a cool glass or porcelain surface held above the container. Use tweezers and tongs. Touch the blue cobalt chloride paper to any visible moisture that collects. Clear liquids can be tested directly (saliva, tears, sweat, etc.). For most liquids the test paper can be used again after it is dried. If the paper is soiled, throw it away.

Set up a water-testing activity center. Be sure to discuss and post safety rules. Make a class chart to record what substances students have found that contains water. The teacher's role is that of program

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manager and consultant. New materials to be tested by heating should be screened by the teacher. Material is acceptable for heating unless it is foul smelling, highly flammable, petroleum-based, or appears dangerous.

STUDENT ROLE

Scientist

MATERIALS

chart paper
markers
a jar of unused cobalt chloride paper
a jar for used cobalt chloride paper
a hot plate
a small Pyrex heating container (a beaker will work)
a glass or porcelain surface on which to collect moisture (a jar or dish will work)
tongs
tweezers
hot mitts
tempera paint
rubbing alcohol
milk
Student Page 1.10.3 TESTING FOR WATER

PRODUCTS

Class chart things that contain water
Completed Student Pages

PROCEDURES

1. **Introduce the activity with a class discussion about water being necessary for living things.**

   Ask such questions as these:
   - Do we contain water?
   - Do other animals contain water?
   - Do plants contain water?
   - How might we find out whether something contains water?

2. **Demonstrate the use of cobalt chloride paper as a water detector.**

   - Show how it changes from blue to red when dipped in water.
   - Show how to get the cobalt chloride paper to turn back to blue by slightly heating it or putting it in the sun.
   - Have students test their saliva and rubbing alcohol.
     ✔ Saliva contains water; rubbing alcohol does not.

3. **Show students the way to find out whether things that stain the paper have water (milk, paints, etc.).**

   - Heat milk in a Pyrex container on a hot plate.
   - Condense some vapor on a cool glass.
     ✔ The vapor will be seen to rise from the milk.
     Use tongs to hold the glass.
   - Test the moisture with cobalt chloride paper.

4. **Show students that things that seem dry may contain water.**

   Heat some leaves in a Pyrex container and test the vapor for water.

5. **Set up a water activity center, divide students into working teams and make rules for doing investigations, and have students make a class chart things that contain water.**

   Some suggested rules are
   - Check with teacher if the material is safe to test.
   - Use the hot plate only with teacher supervision.
   - Use tongs and hot mitts to handle hot things.
   - Be sure to record and validate your results.

   The Class Chart should include
   - What was tested.
   - The result of tests (water or no water found).
   - Who ran the test.

- The date of the test.
- Result of the validation test.
- Who ran the test.
- Date of the test.

Teams must validate their own work. Someone from a different group may run the same test for further validation.

6. **Summarize and discuss the activity with the class.**

Ask questions such as the following

- In what kinds of things did you find water?
- What kinds of things did you find that contained no water?
- Do living things seem to contain water? What kinds of living things?
- Do once-living things seem to contain water? What kinds of once-living things?
- Do non-living things seem to contain water? What kinds of non-living things?

DASH

TESTING FOR WATER
SP 1.10.3

Name: ______________________

Date: ______________________

DATE	SCIENTIST	MATERIAL TESTED	RESULTS		VALIDATION TEST		
			YES WATER	NO WATER	WHO?	DATE	YES/NO

2.7.10 BELTS AND PULLEYS

OBJECTIVES

The students
- Use carpentry skills.
- Make pulley boards.
- Assemble various pulley combinations.
- Make and test predictions about the direction one pulley will turn another.
- Make and test predictions about the number of times one pulley will turn another.
- Invent ways to connect pulleys to solve problems.

BACKGROUND

This activity should follow Activities 2.2.8 ANALOG TIME and 2.7.9 BIKES AND TRIKES and precede Activities 2.7.11 FAST AND SLOW PULLEYS and 2.7.12 GEARS AND WHEELS. BELTS AND PULLEYS looks at the directions wheels rotate and how that direction can be changed. The terms *clockwise* and *counterclockwise* reinforce use of analog clocks.

Sprockets

When a pulley has teeth to engage a chain, it is called a *sprocket.* Bicycles have one or more sprockets attached to the pedals and one or more attached to the rear wheel. These sprockets or special pulleys are connected by a special belt, the chain.

Approach

After reviewing their work with bikes and trikes, the students make a pulley board to hold their pulleys. Then they are given four investigations and a set of challenges to explore.

Making pulley boards

Pulley boards start with a board 1 or 2 in thick, 6 or more inches wide, and 10–12 in long.

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Pulleys can be metal or plastic lids with a hole in their center.

- Lid centers can be found by tracing the lid on paper, cutting out the tracing, and folding the paper in fourths. The center will be at the tip of the center fold.
- To prevent splitting, plastic lids will need to have a pre-drilled hole in their center.
- Holes can be made in metal lids with a hammer and a nail. Be sure the surface beneath the lid is protected.
- Remove the burs with a metal file or metal sandpaper.
- Lids can be placed either top down or up.
- Axles to secure the lids to the board can be made from flat-headed upholstery tacks or nails.
- Lids should turn freely on their axles.
- To prevent tacks and nails from going through the board use a 1/2–3/4-inch tacks and nails.
- Tacks need not be driven deeply into the board since they only hold the pulleys in place. The shallower tacks are driven, the easier it is to remove them and reposition the pulley.
- Belts can be rubber bands or string.

Tool Safety

Students need to be instructed in how to use all tools. A miter box is suggested to guide saw cuts. Sawing, drilling, and use of hot glue guns will need to be supervised by an adult. This is an opportunity to involve parents. Goggles and face masks should be used to protect eyes from flying objects when hammering.

STUDENT ROLES

Physicist
Inventor
Engineer

MATERIALS

bicycle
tricycle
scrap lumber to make pulley boards 1 in x 6 in x 12 in (or larger and/or thicker)
sixpenny nails to punch axles
jar lids of various sizes (metal or plastic)
plastic straws
metal file or metal sandpaper
hand drill with a small bit to make holes in plastic lids
saw

miter box
C-clamps 3-inch or larger to hold miter box in place
hammer
flat-headed upholstery tacks 1/2–3/4-inch or small nails with heads for pulley axles
large rubber bands for belts (medium weight)
string
Student Page 2.7.10 BELTS AND PULLEYS

PRODUCTS

Pulley systems
Completed Student Pages

PROCEDURES

1. **Have the students review the differences between trikes and bikes.**

   Ask such questions as these:
   - How is the way that you move the wheel on a bike different from the way you move the wheel on a trike?
     ✔ Work from the idea that on a trike you move the front wheel with pedals directly connected to it. On a bike, a sprocket attached to the back wheel is turned by a chain connected to a front sprocket. The pedal is attached to the front sprocket.

   - How is the trike different from the bike when you make one round of a pedal?
     ✔ Get at the idea that with each complete turn of the trike pedal the wheel turns once. With each complete turn of the bike pedal the wheel turns several times.

   - What direction does the sprocket on the wheel of the bike turn when compared to the direction the pedals turn? The same way? A different way?
     ✔ Test using a bike to verify that it is the same direction.

2. **Introduce the making of pulley boards. See Figure 2.7.10(1).**

   Review or demonstrate the following
   - How to use a miter box, saw, hammer, drill, and other tools.

- How to find the centers of lids.
  ✔ Trace the lid on paper. Cut the tracing out and fold in half, then in quarters. Place the folded template on the wheel. The center will be at the tip of the center folds.

- That the lids must turn freely and not wobble.

3. **Have small groups of students make pulley boards.**

   Help them do the following
   - Make two pulleys of the same size.
     ✔ Have the students drive nails through the center of metal lids and sand away the burs so the lids turn freely. Pre-drilled plastic lids can also be used.
   - Use the Inventor's Box to invent a way to connect one pulley so it will turn the other.
     ✔ Work to the use of rubber bands, string, and so forth.

   - Share their inventions.

4. **Have the students carry out Investigation 1 about the direction belt-connected pulleys turn. Have them report their results on Student Page 2.7.10 BELTS AND PULLEYS.**

   Have them
   - Connect two pulleys of the same size with a belt. See Figure 2.7.10[1].

   - Predict which direction a pulley will turn when they turn the pulley it is connected with clockwise. Counterclockwise.
     ✔ This is an opportunity for a quick review of the analog clock and the direction its hands move.

   - Test their predictions and help them record what actually happened using the drawing on Student Page 2.7.10.

   - Share their findings.
     ✔ Work to clear descriptions so it is obvious that the students are seeing and saying the same things.

5. **Have the students carry out Investigation 2 about the relative number of times belt-connected pulleys of the same size turn. Have them record their predictions and observations on Student Page 2.7.10.**

Have them

- Use the two pulleys of the same size and connect them with a belt as before.
- Predict the number of times one pulley turns another of the same size when they are connected by a belt. Turn one pulley clockwise one turn. Counterclockwise one turn.
- Test their predictions and record what actually happens.
- Share their findings and descriptions so it is obvious that the students are seeing and saying the same things.

6. **Have the students carry out Investigation 3 by inventing a way to connect pulleys with a belt and get the pulleys to go in opposite directions. See Figure 2.7.10(2). Have them record their predictions and results on Student Page 2.7.10.**

7. **Have the students carry out Investigation 4 by inventing a way to connect pulleys on opposite sides of the board with a belt so that one pulley drives the other. See Figure 2.7.10(3). Have them record their predictions and results on Student Page 2.7.10.**

Ask such questions as these:

- How did you connect your pulleys?
- In what direction or directions did the pulleys move?
  ✓ If the pulleys have been connected as shown in Figure 2.7.10[3], they will move in opposite directions.
- Can anyone invent a way to go around corners so that the rubber bands are not worn badly?
  ✓ Get at such things as smoothing the edges of the board, using straw bumpers or wheels, and so forth to reduce friction.
- Can everyone get two pulleys on opposite sides of the board to move in the same direction?
  ✓ If the belt is crossed or twisted once, as in Investigation 3, the pulleys will move in the same direction.

8. **Give the students a challenge set of construction problems and have them share their solutions.**

Include such questions as these:

- What is the smallest number of pulleys of the same size that can be connected in a circle of three or more so all the pulleys move?
- Will any number of pulleys work?
- Can you make a system with pulleys in a circle where every other pulley goes the opposite direction?
- Can you get the pulleys on opposite sides of the board moving in the same direction without using a belt?
  ✓ They might drill a hole through the board and attach the lids on either side to an axle.

9. **Have the students freely explore to solve their own problems.**

Help them do the following

- Make and record predictions before testing.
- Share their findings and discoveries about their systems.

EXTENSION

- Make a class chart about pulleys and belts and have the students report on how pulleys and belts are used in devices they find.

ILLUSTRATIONS

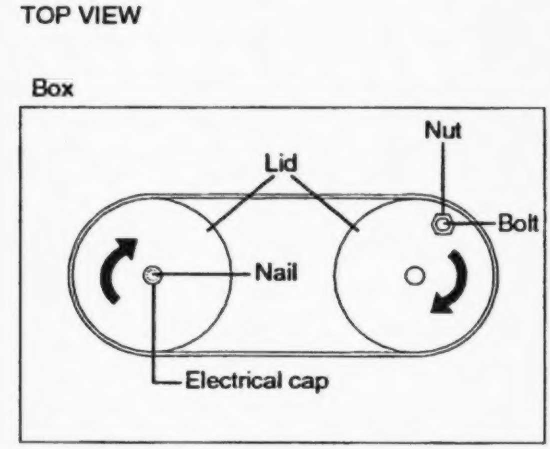

TOP VIEW
Box
Nut
Lid
Bolt
Nail
Electrical cap

Figure 2.7.10(1) Pulley system with pulleys turning in the same direction.

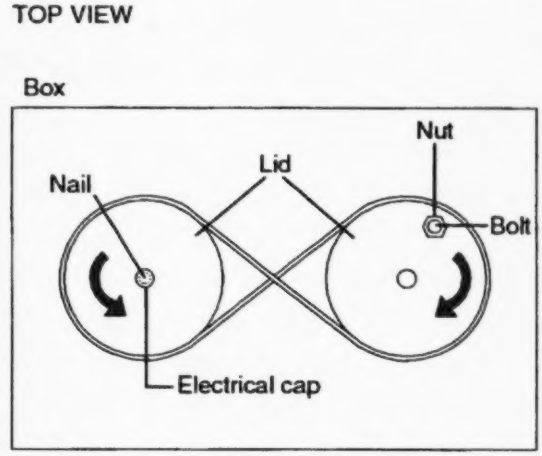

TOP VIEW
Box
Nut
Lid
Nail
Bolt
Electrical cap

Figure 2.7.10(2) Pulley system with pulleys turning in opposite directions.

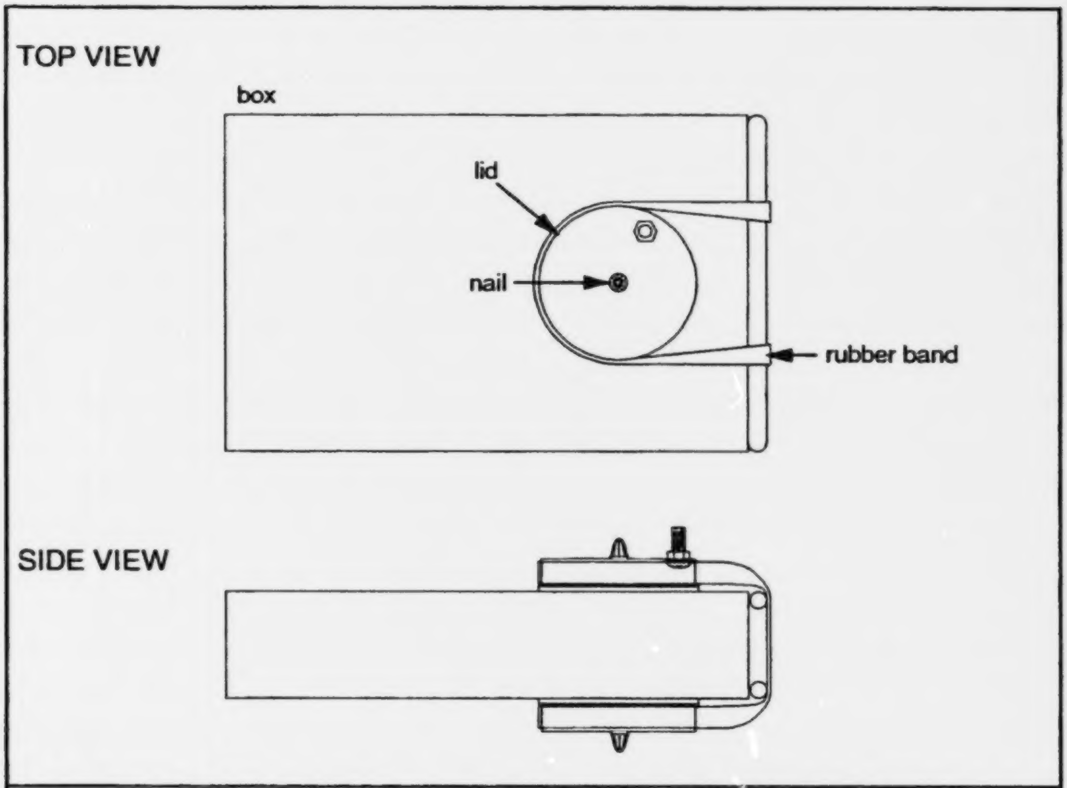

TOP VIEW
box
lid
nail
rubber band
SIDE VIEW

Figure 2.7.10(3) Pulley system with the top pulley driving the bottom pulley.

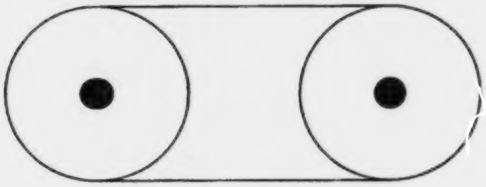
DASH

BELTS AND PULLEYS
SP 2.7.10

Name: ______________________

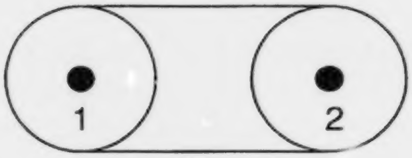
Date: ______________________

INVESTIGATION 1



Draw arrows to show how the pulleys move.

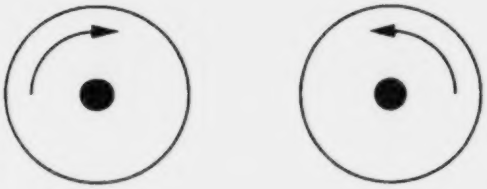
INVESTIGATION 2



NUMBER OF TURNS

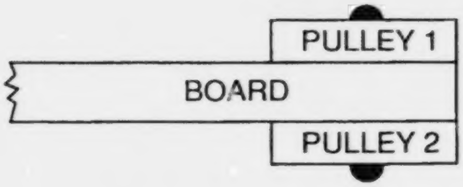
PULLEY 1	PULLEY 2	
	PREDICTION	OBSERVATION

INVESTIGATION 3



Show how you connected the pulleys so they moved in opposite directions.

INVESTIGATION 4



Show how you connected your pulleys.

2.7.11 FAST AND SLOW PULLEYS

OBJECTIVES

- Assemble different pulley combinations of large and small pulleys.
- Make and test predictions about the relative number of times one pulley will drive another.
- Invent complex pulley systems.

BACKGROUND

This activity follows Activity 2.7.10 BELTS AND PULLEYS and precede 2.7.12 GEARS AND WHEELS. In FAST AND SLOW PULLEYS the students explore driving large pulleys with small pulleys and small pulleys with large pulleys. The activity provides an explanation of the anomaly of the relative distance traveled by bikes and trikes per complete rotation of the pedals. It also provides further insights into how a slow-moving pulley can drive a fast-moving pulley. The students modify the pulley boards from Activity 2.7.10 BELTS AND PULLEYS.

Straws, lids, and pulleys

A stiff plastic straw slipped over a nail makes a good small pulley. The students should check to be sure the straw pulley turns freely on the nail. A pointer can be invented to help count its of turns. A toothpick taped to the straw works well. See Figure 2.7.11(1).

A *combination pulley* can be made by attaching a large lid to a small lid so that they use a common axle. Then pulley combinations such as a large pulley driving a small pulley glued to a large pulley that drives another small pulley can be made. These systems of pulleys can produce a spectacular number of turns in the last pulley in the system. See Figure 2.7.11(2). Use a hot-glue gun to bond the two lids together. Pulleys can also be wired together. Then put a center hole through both lids with a drill or nail and hammer for the axle.

A metal lid can be slid over a straw to make a combination pulley one of which is relatively large and the other quite small. A hole in the center of the lid made with a twelve penny nail has rough edges. These edges will grasp the straw, keeping the lid from slipping. See Figure 2.7.11(3).

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Counting the turns of pulleys
The students may invent several ways of counting the number of turns a pulley makes. One simple method is for the student to mark the pulley and the board and count the number of times the mark on the pulley passes the mark on the board. They can use tape or marking pens.

STUDENT ROLES

Physicist
Inventor
Engineer

MATERIALS

bicycle with a derailer gearshift (gearshift with multiple external sprockets) if possible
tricycle
pulley boards from Activity 2.7.10
  scrap lumber to make pulley boards 1 in x 6 in x 12 in (or larger and/or thicker)
sixpenny nails to punch axles
twelve penny nails to make holes for straws
6-in nails to hold straw pulleys
jar lids of various sizes (metal or plastic)
stiff plastic straws
sandpaper
hand drill with a small bit to make holes in plastic lids
hot-glue gun to glue lids together or wire to wire lids together
saw
hammer
3/4 and 1 1/2-inch flat-headed upholstery tacks or nails with heads for pulley axles
large rubber bands for belts (medium weight)
string
marking pens
tape
Student Page 2.7.11 FAST AND SLOW PULLEYS

PRODUCTS

Pulley systems
Completed Student Pages

PROCEDURES

1. **Review what has been observed about trikes and bikes and belts and pulleys.**

   Ask such questions as these:
   - How did you connect belts so that two pulleys would go in the same direction?
     ✔ Have a student demonstrate on a pulley board.

   - How did you connect belts so that two pulleys would go in opposite directions?
     ✔ Have a student demonstrate on a pulley board.

   - How could you arrange pulleys so that they would look more like the sprockets and chain of a bike?
     ✔ Have the students look at a bike's sprockets. Work for the idea that they need a pair of pulleys, one large and one small.

2. **Have the students use the pulley boards from Activity 2.7.10 BELTS AND PULLEYS to make a system with a large pulley and a small pulley. Have them invent ways to count the number of times a small pulley goes around compared to the number of times a larger pulley connected with a belt goes around. Help them explore the system. Have them report their results on Student Page 2.7.11 FAST AND SLOW PULLEYS.**

   Ask such questions as these:
   - How did you count the number of turns that the small pulley made for one turn of the large pulley?
     ✔ Work for some way to know when the wheel has made a complete turn.

   - What generalizations can you make about the number of turns a large pulley makes compared to a smaller pulley with a belt?
     ✔ Work to the ideas that the large wheel will turn fewer times than the smaller wheel and conversely, the small pulley will turn more times for one turn of the large pulley..

3. **Have the students apply their understanding of pulleys to bikes and trikes.**

Ask such questions as these:

- When you look at one turn of the pedals of a trike and a bike, what is the advantage of the bike over the trike?
  ✔ Work to the idea that you can get the bike wheel to turn several times for each complete rotation of the pedals. For one rotation of the pedals the trike wheel turns only once. Review this while observing a bike and a trike.

- Which is easier to turn on a bike, a small sprocket that turns a bigger sprocket or a big sprocket that turns a smaller sprocket?
  ✔ Work for agreement that it is easier to turn the small sprocket that turns the bigger sprocket just as it is easier to turn the small pulley that turns the bigger pulley.

4. **Demonstrate first how to make a small pulley from a straw and nail and then how to make a combination pulley by gluing or wiring together a large and small lid and/or slipping a metal lid over a straw. See the Background.**

5. **Give the students a challenge set of construction problems and have them share their solutions.**

Include such things as the following

- How fast can you make a system of pulleys go?
  ✔ Several single or combination pulleys can be put in a row to drive each other so that large pulleys drive smaller pulleys.

- How slow can you make a pulley system go?
  ✔ Several single or combination pulleys can be put in a row to drive each other so that smaller pulleys drive larger pulleys.

- How many different pulleys can be put in a connected system with each turning a different number of times?
  ✔ Ask how you know they are turning a different number of times. Ask what limits the number of pulleys you can use.

6. **Have the students explore different pulley arrangements of their own design.**

For each system have the students predict the following

- Which way the pulleys will turn.

- Which pulleys will go the fastest and/or slowest.

7. **To summarize, have each group show their most interesting pulley system and explain how it works.**

   Have the class predict the following
   - How the pulleys will turn.
   - Which pulleys will turn the most number of times.

EXTENSION

- Post a challenge asking the students how they could predict how far a real bicycle will go with one turn of the pedal. They will need to know (a) the distance around the rear wheel (its circumference) and (b) the number of turns the rear wheel makes with one complete turn of the pedals. The circumference of the wheel can be marked on the floor and measured with a meter-string can.

ILLUSTRATIONS

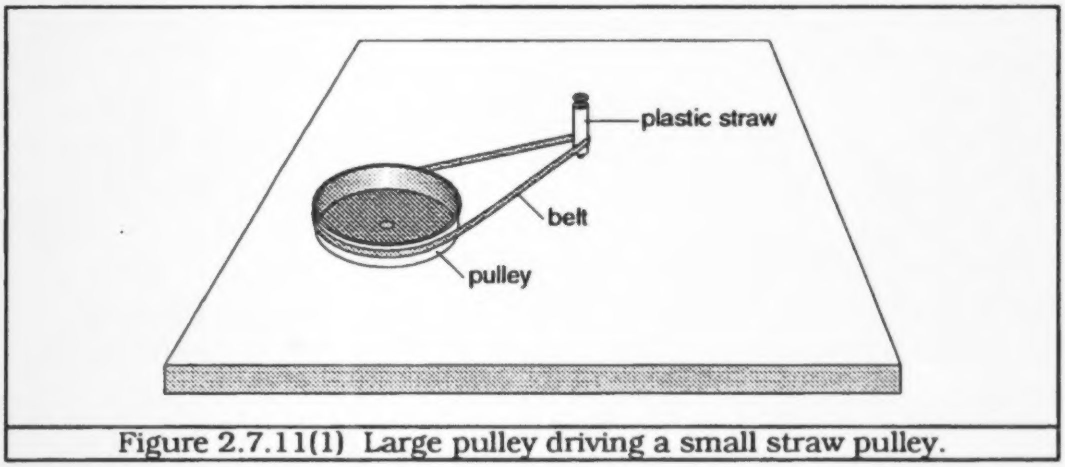

Figure 2.7.11(1) Large pulley driving a small straw pulley.

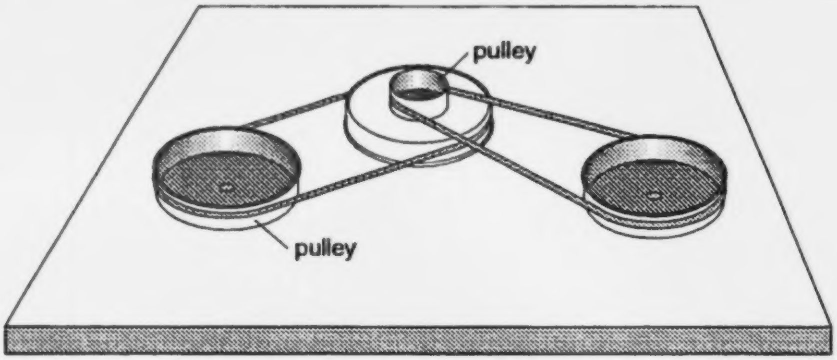
pulley
pulley

Figure 2.7.11(2) Large pulley driving a combination pulley attached to a second large pulley.

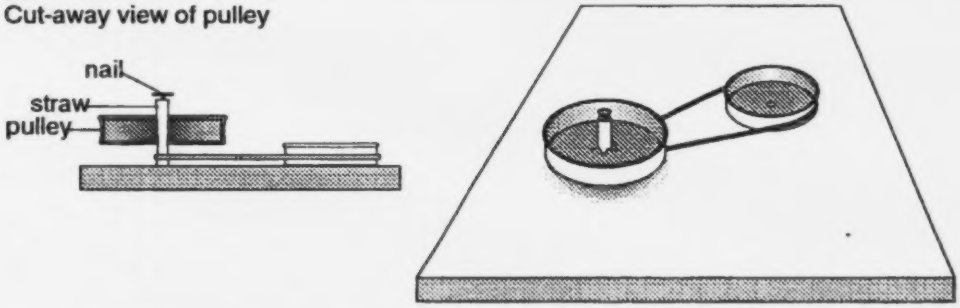
Cut-away view of pulley
nail
straw
pulley

Figure 2.7.11(3) Straw-and-lid combination pulley system.

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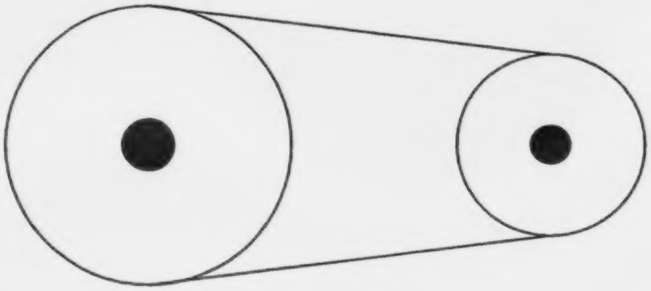
DASH

FAST AND SLOW PULLEYS
SP 2.7.11

Name: ______________________

Date: ______________________



BIG PULLEY TURNS	SMALL PULLEY TURNS
1 TURN	

Fill in the blanks.

A big pulley connected to a small pulley makes the small pulley go around ___________ times than the big pulley.

A small pulley connected to a big pulley makes the big pulley go around ___________ times than the small pulley.

It's easier to turn a ___________ pulley than it is to turn a ___________ pulley.

DASH

GRADE 3

ACTIVITY PLANS

Grade 3 DASH: Suggested Year 1 Activity Plan

CLUSTER	AUG	SEPT	OCT	NOV	DEC	JAN	FEB	MARCH	APRIL	MAY	JUNE
1. Learning	3.1.1-LearnCal 3.1.3-RespCht	3.1.1,3 3.1.2-LstYr 3.1.4-5-Pln&Org	3.1.1-5	3.1.1-5	3.1.1-5	3.1.1-5 3.1.9-Gls (3.1.13-CnSkInv)	3.1.1-5	3.1.1-5	3.1.1-5	3.1.1-5	3.1.1-5 3.1.9-Gls 3.1.13-CnSkInv
2. Time, Weather, & Sky	3.2.1-Weather	3.2.2-Temp 3.2.3-Wind 3.2.4-Rain				3.2.7-MoonGrph	3.2.7-MG 3.2.2-Tmp (3.2.4-Sn)	3.2.7-MG	3.2.7-MG 3.2.2-Tmp	3.2.7-MG-Sumry	
3. Animals		3.3.1-Pet							3.3.2-3-Insects		
4. Plants								3.4.1-2,7,8-Garden	3.4.8,10-GardnCare 3.4.13-Flwr	3.4.8,10-GardnCare	3.4.12-GardHarv
5. Food and Nutrition				3.5.1-FdGp (3.5.6,8-DryFd,Rot)				3.5.1-2-SelGPlnt			
6. Health and Safety	3.6.1-Grow (3.6.2-Teeth)						3.6.3-6,8 Lungs&Ht 3.6.12-Drg (3.6.2-Tth)				3.6.1-Grow (3.6.2-Teeth)
7. Way-finding										3.7.3-PropBoat	
8. Energy & Communi-cation										3.8.2-3-Wind,Prop 3.8.10-EDf	
9. Conserv., Recycling, & Decompos.		3.9.5-FallBury	3.9.1-MkCmpst					3.9.4-UseCmpst		3.9.6-SpgDigUp	
10. Matter, Space, & Construction			3.10.12-MsCan (3.10.13-SafEq)	3.10.12-Balance	3.10.12-Vol	3.10.2-3-Acd&Bas (3.10.13-SafEq)					
NOTES	LearnCal Records Start Up	ClsrmOrg Weather	Compost Measurmt	Food (PresvRt) Measurmt	Measurmt	Moon Acid&Base	Health	Garden	Plants Insect	Wind Energy Boat	Finish Up

BEST COPY AVAILABLE

Grade 3 DASH: Suggested Full Implementation Activity Plan

CLUSTER	AUG	SEPT	OCT	NOV	DEC	JAN	FEB	MARCH	APRIL	MAY	JUNE
1. Learning	3.1.1-3 LearnCal, RC,SRB, etc	3.1.1-3 3.1.4-5,8 Pln&Org	3.1.1-5	3.1.1-5	3.1.1-5 3.1.6-7-Frnds,G&R	3.1.1-5 3.1.9-10 Gls &Aph 3.1.13-CSI	3.1.1-5	3.1.1-5	3.1.1-5	3.1.1-5 (3.1.12-CarGard)	3.1.1-5 3.1.9-Gls 3.1.11-NYr 3.1.13-CSI
2. Time, Weather, & Sky	3.2.1-Weather (3.2.11-Ecl as needed)	3.2.2-4-Weather 3.2.6-SunGph	3.2.6-SG 3.2.5-Hum 3.2.8-9-PolConst	3.2.6-SG	3.2.6-SG 3.2.10-PolConst	3.2.6-SG 3.2.7-MoonGrph (3.2.4-Sn)	3.2.6-7-Gs (3.2.10-Venus) 3.2.2-Tmp	3.2.6-7-Gs 3.2.10-PolConst	3.2.6-7-Gs 3.2.2-Tmp	3.2.6-7,9-Mn&SunG, PolConst Summry	3.2.6-7
3. Animals	3.3.1-Pet					3.3.10-12-Chicks			3.3.2-4-Insects 3.3.5-9-Frogs		
4. Plants								3.4.1-2,7,8 -Garden 3.4.3-6-Soil	3.4.8-11-GardnCare 3.4.13-14 Flwr&Sds	3.4.8-11-GardnCare	3.4.12-GardHarv
5. Food and Nutrition				3.5.1-FdGp 3.5.6-8-PresFd,Rot	3.5.6-8-PresFd,Rot		3.5.1,9-13-Supermkt	3.5.1-2-SelGPlnt		3.5.3-PlanFst	3.5.4-5-Feast
6. Health and Safety	3.6.1-Grow (3.6.2-Teeth)					3.6.3-11-Lg,Ht,Grm 3.6.12-13-Drugs	(3.6.2-Tth)				3.6.1-Grow (3.6.2-Teeth)
7. Way-finding							3.7.4,(2)-DelSys	(3.7.1-GMvr)		3.7.3,(2)-PropBoat	
8. Energy & Communi-cation		3.8.1-2-Wind					3.8.7-9-MessSys			3.8.3-6 Propell 3.8.10-EnrgyDef	
9. Conserv., Recycling, & Decompos.		3.9.1-3 MkCmpst 3.9.5-FallBury						3.9.4-UseCmpst		3.9.6-SpgDigUp	
10. Matter, Space, & Construction		3.10.12-MSCan 3.10.13-SafEquip	3.10.12-Vol 3.10.2-9-Acd&Bas	3.10.2-9-Acd&Bas		3.10.12-Balance	3.10.10-11 Suprmkt	3.10.1-AorB Soil			
NOTES	LearnCal Records Start Up	ClsrmOrg Weather Wind Compost	Astron Humidity Acid&Base	Acid&Base Food	Food Friends Giv&Rec	Goals Moon Chicks Health	Supermkt	Garden	Plants Insect Frogs	Astronomy Propellors Boat	Feast Finish Up

BEST COPY AVAILABLE

DASH Activities School Year Planning Form

CLUSTER	AUG	SEPT	OCT	NOV	DEC	JAN	FEB	MARCH	APRIL	MAY	JUNE
1. Learning											
2. Time, Weather, & Sky											
3. Animals											
4. Plants											
5. Food and Nutrition											
6. Health and Safety											
7. Way-finding											
8. Energy & Communication											
9. Conserv., Recycling, & Decompos.											
10. Matter, Space, & Construction											
NOTES and ORGANIZING IDEAS											

DASH

GRADE 3

SCOPE & SEQUENCE

ACTIVITY LISTS

GRADES K–5 DASH SCOPE AND SEQUENCE OF ACTIVITIES

CLUSTER	GRADE K	GRADE 1	GRADE 2	GRADE 3	GRADE 4	GRADE 5
Learning	Learning Calendar Home Learning Calendar Calendar Review Responsibility Chart Science Record Book Using Our Senses Same and Different Physical Characteristics Functions of Things Working Dictionary Wonder and Discover Book Connections Book Families Families and Helping Making Friends Being Friends School and Home Concept and Skill Inventory	Learning Calendar Responsibility Chart Planning Calendar Last Year Helping Working Together Taking Turns and Sharing Concept and Skill Inventory	Learning Calendar Last Year Aphorisms Helping Others Getting Help Making and Keeping Friends Turns School, Teacher, Friends, and Family Predictions about Tomorrow Planning for Tomorrow Thinking Library Concept and Skill Inventory	Learning Calendar Last Year Responsibility Planning Organizing Our Environment Friends Giving and Receiving Working Together Helping Myself and Others Aphorisms Next Year Science & Technology Concept and Skill Inventory	Learning Calendar Responsibility Last Year Library Working Together Things I Can Do for Myself and Others Aphorisms Planning Survival Game Concept and Skill Inventory	Learning Calendar Responsibility Library Working Together Things I Can Do for Myself and Others Aphorisms Friendship Concept and Skill Inventory
Time, Weather, and Sky	Weather Watch Beginnings Endings Day and Night Days, Weeks, and Months Moon Watch Moon Phases Seasons Clocks and Calendars	Sky and Weather Watch Rain and Streams Snow and Streams Digital Clock Hours and Minutes Time Line Sunrise and Sunset Night and Day The Sun The Seasons Making a Clock	Temperature Wind Sunrise, Sunset, and Seasons Moonrise and Moonset Rain Snow Digital Time Analog Time	Weather Temperature Wind Rain and Snow Humidity Sunrise and Sunset Moon Phases Polar Sky Model Polar Constellations Venus Eclipses	Rainfall and Snowfall Wind Direction & Speed Height of Clouds Clouds and Weather Storm Clouds Humidity and Wind Chill Lightning Weather Maps Weather Fronts Predicting Weather Flat or Round Earth? Length of Day and Night The Sun's Shadow Path The Planetarium Planets When Is It Noon? Making and Using a Sundial Seasons and the Sun Moon Phases and the Sun Eclipses	Weather Station Heat Index Weather Prediction Clouds and Fronts Triangles Gnomon Size of Earth Moon Through a Telescope How Big and Far Away Is the Moon? Paths of Celestial Bodies Models of the Solar System

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GRADES K–5 DASH SCOPE AND SEQUENCE OF ACTIVITIES

CLUSTER	GRADE K	GRADE 1	GRADE 2	GRADE 3	GRADE 4	GRADE 5
Animals	Appropriate Pets Classroom Animals Caring for Animals Living, Once-living, and Nonliving Things Animals and Plants Animal Environments Uses for Animals How Bugs Walk Parts of Bugs Parts of Mammals People Animals and Food Animals and Water Animals and Air Animal Wastes How Animals Keep Warm How Animals Keep Cool Real or Imaginary	Classroom Pets Living &and Nonliving Things Defining Living and Nonliving Things Animal Survey Animal Key Animal Needs Planning to Raise a Small Animal Building Cages Metamorphosis	Classroom Pets Classroom Aquarium External Anatomy of Fish Biological Needs of Fish Reproduction and Development of Fish Finding Insect Eggs Hatching Insect Eggs Early Metamorphosis Late Metamorphosis Collecting Spiders Insects and Spiders Spider Food Spider Care Spiders as Predators Spider Webs	Classroom Pets Raising Insects Comparing Insects Importance of Insects Frog and Toad Habitats Raising Frogs and Toads Frog Metamorphosis Importance of Frogs and Toads Toads and Insects Hatching Chicks Chick Growth Importance of Birds	Pet Care Unincubated Egg Chick Embryology Raising Small Mammals Reproduction of Pet Mammals Pet Baby Care Our Early Years The First Grade Child Development of Pets Human Development Changing Dimensions Anatomy of Fish Fish Reproduction Digestive, Circulatory, and Reproductive Systems Migration and Hibernation Fall, Winter, and Spring Birds	Pet Care Birds I Know Cells Male Urogenital System Female Urogenital System Ovulation Cycle Ovulation and Pregnancy Embryology Body Changes Bones Skeletal System Muscles Muscular System Chemistry and Bones The Senses The Eye Sound The Ear
Plants	Plant Parts Plant Environment Plant Uses Growing Bean Sprouts Plants and Water Gardening	Plant Identification Plant Survey Plant Pressing Plant Key Plant Needs Plant Life Cycle Edible Plant Parts Plant Parts Animals Eat	Soil Making Soil Soil and Plants Soil Uses Finding Soil Pipes and Water Moving Water: Gravity Moving Water: Pumps Vegetable and Flower Gardens in a Bucket Rooting Stems Rooting Bulbs and Tubers Roots and Water Growing Root Vegetables Tree Planting	Garden Planning Garden Preparation Watching Garden Soil Making Artificial Soil Testing Soil Soil and Water Garden Planting Garden Care Watering Systems Garden Invaders Controlling Insects Garden Harvesting Flowers Seeds Pollination	Annual, Biennial, and Perennial Plants Fungi	Annual, Biennial, and Perennial Plant Project Tree Harvesting Tree Planting Tree Observation Measuring Trees Age of Trees Trees, Shrubs, and Grasses Grasses: Why Do They Grow There? Roots Soil Conservation
Food and Nutrition	Bean Sprout Salad Drinks Flour and Bread Familiar Foods Favorite Foods New Foods	Food Groups Cooking Measuring Volume	Supermarket Survey Food Preference Food Groups New Foods Properties of Foods Changing Flavor Milk, Butter, and Cheese Energy from Food	Nutritious Food Selection Plants for the Garden Class Feast Drying and Pickling Foods Preserving and Rotting Supermarket Game Pricing Foods Food Ads	Nutrients Mechanical Digestion Chemical Digestion Food Groups Preserving Foods	Nutrients Nutrients and Cells Food Labeling

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GRADES K–5 DASH SCOPE AND SEQUENCE OF ACTIVITIES

CLUSTER	GRADE K	GRADE 1	GRADE 2	GRADE 3	GRADE 4	GRADE 5
Health and Safety	Growth Chart Tooth Chart Tooth Care Exercise Germs Washing Hands Bathrooms and Basins Aprons Fountains and Faucets Getting Sick Feeling Sick Going to the Doctor What Doctors Do Going to the Hospital Raincoats Testing Raincoats Wet and Cold Keeping Warm Indoors Hand and Foot Protection Getting Lost	Growth Chart Tooth Chart Brushing Teeth Chewing Air and Breathing Getting Hurt Staying Healthy Safety Rules	Growth Chart Tooth Chart Tooth Care Getting Hurt Getting Sick Staying Well Classroom and Playground Safety Fire Safety Using 911	Growth Chart Tooth Chart Breathing Air Anatomy of Breathing Lung Model Lungs and Smoking Breathing and Pulse Heart, Veins, and Arteries Heart, Lungs, and Exercise Disease Transmission Trash and Sanitation Helpful Drugs Proper Drug Use	Growth Chart and Area Measurement Tooth Chart Safety Gear Safety and Putting Out Fires Making a Fire Things That Burn Smoking and the Lungs Alcohol, Tobacco, and Drugs	Growth Chart and Area Measurement Tooth Chart Alcohol, Tobacco, and Drugs Sexually Transmitted Diseases Safety Devices Smokers' Surveys Smoking Laws Alcohol Laws Chris's Story The Parents' Story Intoxication Drug Laws
Wayfinding and Transportation	Right and Left Sunrise Sunset North and South Rising Moon Setting Moon Home Location Sidewalks & Walkways Roads Traffic Simulation Traffic Rules Mapping	Pacing North, South, East, and West Home Map Distance Making a Boat Making a Lake The Great Regatta Floating and Sinking Draining a Lake	Transportation Systems Making Race Cars Racing Cars Roads Building a Village Pedestrians in the Village Bikes in the Village Cars in the Village Bikes and Trikes Belts and Pulleys Fast and Slow Pulleys Gears and Wheels	Garden Mover Propeller-Driven Message Center Propeller-driven Boat Delivery Systems	Boat Design Wind and Sails	Where in the World Are We? Planetarium Mapping the Sky The North Pole, Equator, and Ecliptic Where Is Earth?

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GRADES K–5 DASH SCOPE AND SEQUENCE OF ACTIVITIES

CLUSTER	GRADE K	GRADE 1	GRADE 2	GRADE 3	GRADE 4	GRADE 5
Energy and Communication	Energy Making Things Move Making Things Stop Turning Things Off Turning Things On Repairing Things	Temperature of Things Master Thermometer Hot and Cold Sources of Energy	Sun and Direction Mirrors and Sunlight Clouds and Sunlight Comparing Temperatures Eclipses	Shadow, Light, and Bubbles Wind and Heat Wind Pulls and Pushes Propellers Driving Propellers Waterwheels Propellers in Water Heliograph Speaking Tube String Telephone Energy Definitions	Push-Pull Measuring Tool Friction Streamlining Pressure, Sharp Edges, and Points Energy of Falling Objects Circles and Speed	Pushes, Pulls, & Forces Teeter-Totters The Balance Wheels and Axles Levers Arms and Jaws Inclined Planes and Screws Block and Tackle Magnetic Pushes and Pulls Magnets and Compasses Magnetic Fields Forces Projects
Conservation, Recycling, and Decomposition	Decomposition Waste Disposal Recycling Project Making Paper	Classroom Resources Conserving Energy Conserving Water Decomposition and Unearthing Decomposition and Reburial Recycling	Fall Unearthing Fall Burying Spring Unearthing Spring Burying Pollution Survey Aluminum Recycling Connections	Making Compost Watching Compost Animals in Compost Using Compost Fall Unearthing and Burial Spring Unearthing and Burial	Unearthing and Burial Recycling Project	Class Recycling Project Class Conservation Project Decomposition and Archeology Pollution Project
Matter, Space, and Construction	Cubby Organization Patterns in Puzzles Making Puzzles Making Envelopes Making Boxes and Bags Volume of Boxes and Bags Packing and Storing Linear Measurement	Meter-string Can Outdoor Study Area Mapping Testing for Water Measuring Volume Plumbing Water Systems Air Bubbles in Water and Air Building with Air Floor Plan Cardboard House Plan Making a Cardboard House Painting the House Furnishing the House Sewing and Weaving Warming andCooling Lighting the House	Desk Organization Notebook Organization The Balance Meter-string Can Measuring Volume	Acidic and Basic Soil Acids and Bases Acid and Base Reactions Diluting Acids and Bases Acid and Base Interactions Dissolving Things Things in Liquids Crystals Rain in a Jar Supermarket Planning Supermarket Construction Measuring Devices Safety Equipment	Linear Measurement Volume Measurement Mass Measurement Collecting Rocks Hardness of Rocks Specific Gravity Rocks and Sharp Edges Making Tools from Rock Clowns: Things That Float Clay Fire and Pottery Air and Fire Fire and Oxygen Properties of Gas	Linear Measurement Volume Measurement Mass Measurement Camera Obscura Controlling Light with Lenses Making a Telescope Stabilizing the Telescope Making a Microscope Making a Hygrometer Making a Barometer

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DASH K
ACTIVITY LIST

CLUSTER 1 LEARNING

K.1.1 THE LEARNING CALENDAR
K.1.2 THE CLASS RESPONSIBILITY CHART
K.1.3 CALENDAR REVIEW
K.1.4 THE HOME LEARNING CALENDAR
K.1.5 THE SCIENCE RECORD BOOK
K.1.6 USING OUR SENSES
K.1.7 SAME AND DIFFERENT
K.1.8 PHYSICAL CHARACTERISTICS OF THINGS
K.1.9 FUNCTIONS OF THINGS
K.1.10 THE WORKING DICTIONARY AND WORKING DEFINITIONS
K.1.11 THE WONDER AND DISCOVER BOOK
K.1.12 THE CONNECTIONS BOOK
K.1.13 FAMILIES
K.1.14 FAMILIES AND HELPING
K.1.15 MAKING FRIENDS
K.1.16 BEING FRIENDS
K.1.17 SCHOOL AND HOME
K.1.18 CONCEPT AND SKILL INVENTORY

CLUSTER 2 TIME, WEATHER, AND SKY

K.2.1 WEATHER WATCH
K.2.2 BEGINNINGS
K.2.3 ENDINGS
K.2.4 DAY AND NIGHT
K.2.5 DAYS, WEEKS, AND MONTHS
K.2.6 MOON WATCH
K.2.7 MOON PHASES
K.2.8 SEASONS
K.2.9 CLOCKS AND CALENDARS

CLUSTER 3 ANIMALS

K.3.1 APPROPRIATE PETS
K.3.2 CLASSROOM ANIMALS
K.3.3 CARING FOR CLASSROOM ANIMALS
K.3.4 LIVING, ONCE-LIVING, AND NOT-LIVING
K.3.5 ANIMALS AND PLANTS
K.3.6 ANIMAL ENVIRONMENTS
K.3.7 USES FOR ANIMALS
K.3.8 HOW BUGS WALK
K.3.9 PARTS OF BUGS
K.3.10 PARTS OF MAMMALS
K.3.11 PEOPLE
K.3.12 ANIMALS AND FOOD
K.3.13 ANIMALS AND WATER
K.3.14 ANIMALS AND AIR
K.3.15 ANIMAL WASTES
K.3.16 HOW ANIMALS KEEP WARM
K.3.17 HOW ANIMALS KEEP COOL
K.3.18 REAL OR IMAGINARY

CLUSTER 4 PLANTS

K.4.1 PLANT PARTS
K.4.2 PLANT ENVIRONMENTS
K.4.3 PLANT USES
K.4.4 GROWING BEAN SPROUTS
K.4.5 PLANTS AND WATER
K.4.6 GARDENING

CLUSTER 5 FOOD AND NUTRITION

K.5.1 BEAN SPROUT SALAD
K.5.2 DRINKS
K.5.3 FLOUR AND BREAD
K.5.4 FAMILIAR FOODS
K.5.5 FAVORITE FOODS
K.5.6 NEW FOODS
K.5.7 SNACKS FROM THE GARDEN

CLUSTER 6 HEALTH AND SAFETY

K.6.1 GROWTH CHART
K.6.2 TOOTH CHART
K.6.3 TOOTH CARE
K.6.4 EXERCISE
K.6.5 GERMS
K.6.6 WASHING HANDS
K.6.7 BATHROOMS AND BASINS
K.6.8 APRONS
K.6.9 FOUNTAINS AND FAUCETS
K.6.10 GETTING SICK
K.6.11 FEELING SICK
K.6.12 GOING TO THE DOCTOR
K.6.13 WHAT DOCTORS DO
K.6.14 GOING TO THE HOSPITAL
K.6.15 RAINCOATS
K.6.16 TESTING RAINCOATS
K.6.17 WET AND COLD
K.6.18 KEEPING WARM INDOORS
K.6.19 KEEPING COOL INDOORS
K.6.20 HAND AND FOOT PROTECTION
K.6.21 GETTING LOST

CLUSTER 7 WAYFINDING AND TRANSPORTATION

K.7.1 RIGHT AND LEFT
K.7.2 SUNRISE
K.7.3 SUNSET
K.7.4 NORTH AND SOUTH
K.7.5 HOME LOCATION
K.7.6 SIDEWALKS AND WALKWAYS
K.7.7 ROADS
K.7.8 TRAFFIC SIMULATION EQUIPMENT
K.7.9 TRAFFIC SIMULATION MAPPING
K.7.10 TRAFFIC SIMULATION RULES
K.7.11 CLASSROOM MAPPING

CLUSTER 8 ENERGY AND COMMUNICATION

K.8.1 ENERGY
K.8.2 MAKING THINGS MOVE
K.8.3 MAKING THINGS STOP
K.8.4 TURNING THINGS OFF
K.8.5 TURNING THINGS ON
K.8.6 REPAIRING THINGS

CLUSTER 9 CONSERVATION, RECYCLING, AND DECOMPOSITION

K.9.1 DECOMPOSITION
K.9.2 WASTE DISPOSAL
K.9.3 RECYCLING PROJECT
K.9.4 MAKING PAPER

CLUSTER 10 MATTER, SPACE, AND CONSTRUCTION

K.10.1 CUBBY ORGANIZATION
K.10.2 PATTERNS IN PUZZLES
K.10.3 MAKING ENVELOPES
K.10.4 MAKING PUZZLES
K.10.5 MAKING BOXES AND BAGS
K.10.6 VOLUME OF BOXES AND BAGS
K.10.7 PACKING AND STORING
K.10.8 LINEAR MEASUREMENT

DASH 1
ACTIVITY LIST

CLUSTER 1 LEARNING

1.1.1 THE LEARNING CALENDAR
1.1.2 THE RESPONSIBILITY CHART
1.1.3 THE PLANNING CALENDAR
1.1.4 THING LEARNED LAST YEAR
1.1.5 HELPING
1.1.6 WORKING TOGETHER
1.1.7 TAKING TURNS AND SHARING
1.1.8 CONCEPT AND SKILL INVENTORY

CLUSTER 2 TIME, WEATHER, AND SKY

1.2.1 SKY AND WEATHER WATCH
1.2.2 RAIN AND STREAMS
1.2.3 SNOW AND STREAMS
1.2.4 THE DIGITAL CLOCK
1.2.5 HOURS AND MINUTES
1.2.6 TIME LINE
1.2.7 SUNRISE AND SUNSET
1.2.8 NIGHT AND DAY
1.2.9 THE SUN
1.2.10 THE SEASONS
1.2.11 MAKING A CLOCK
1.2.12 MOONRISE AND MOON SET

CLUSTER 3 ANIMALS

1.3.1 LIVING AND NON-LIVING THINGS
1.3.2 DEFINING LIVING AND NON-LIVING THINGS
1.3.3 ANIMAL SURVEY
1.3.4 ANIMAL KEY
1.3.5 ANIMAL NEEDS
1.3.6 PLANNING TO RAISE A SMALL ANIMAL
1.3.7 BUILDING CAGES
1.3.8 METAMORPHOSIS
1.3.9 CLASSROOM PETS

CLUSTER 4 PLANTS

1.4.1 PLANT IDENTIFICATION
1.4.2 PLANT SURVEY
1.4.3 PLANT PRESSING
1.4.4 PLANT KEY
1.4.5 PLANT NEEDS
1.4.6 PLANT LIFE CYCLE
1.4.7 EDIBLE PLANT PARTS
1.4.8 PLANT PARTS ANIMALS EAT

CLUSTER 5 FOOD AND NUTRITION

1.5.1 BASIC THREE FOOD GROUPS
1.5.2 COOKING
1.5.3 MEASURING VOLUME

CLUSTER 6 HEALTH AND SAFETY

1.6.1 GROWTH CHART
1.6.2 TOOTH CHART
1.6.3 BRUSHING TEETH
1.6.4 CHEWING
1.6.5 AIR AND BREATHING
1.6.6 GETTING HURT
1.6.7 STAYING HEALTHY
1.6.8 SAFETY RULES

CLUSTER 7 WAYFINDING AND TRANSPORTATION

1.7.1 PACING
1.7.2 NORTH, SOUTH, EAST, AND WEST
1.7.3 HOME
1.7.4 MAP DISTANCE
1.7.5 MAKING A BOAT
1.7.6 MAKING A LAKE
1.7.7 THE GREAT REGATTA
1.7.8 FLOATING AND SINKING
1.7.9 DRAINING A LAKE

CLUSTER 8 ENERGY AND COMMUNICATION

1.8.1 TEMPERATURE OF THINGS
1.8.2 THE MASTER THERMOMETER
1.8.3 HOT AND COLD
1.8.4 SOURCES OF ENERGY

CLUSTER 9 CONSERVATION, RECYCLING, AND DECOMPOSITION

1.9.1 CONSERVING CLASSROOM RESOURCES
1.9.2 CONSERVING ENERGY
1.9.3 CONSERVING WATER
1.9.4 DECOMPOSITION AND UNEARTHING
1.9.5 DECOMPOSITION AND REBURIAL
1.9.6 RECYCLING

CLUSTER 10 MATTER, SPACE, AND CONSTRUCTION

1.10.1 METER–STRING CAN
1.10.2 OUTDOOR STUDY AREA MAPPING
1.10.3 TESTING FOR WATER
1.10.4 PLUMBING
1.10.5 WATER SYSTEMS
1.10.6 AIR
1.10.7 BUBBLES IN WATER
1.10.8 BUBBLES IN AIR
1.10.9 BUILDING WITH AIR
1.10.10 FLOOR PLAN
1.10.11 FLOOR PLAN MODEL
1.10.12 CARDBOARD HOUSE PLAN
1.10.13 MAKING A CARDBOARD HOUSE
1.10.14 PAINTING THE HOUSE
1.10.15 FURNISHING THE HOUSE
1.10.16 SEWING
1.10.17 WEAVING
1.10.18 WARMING AND COOLING THE HOUSE
1.10.19 LIGHTING THE HOUSE
1.10.20 SAFETY EQUIPMENT

DASH 2
ACTIVITY LIST

CLUSTER 1 LEARNING

2.1.1 THE LEARNING CALENDAR
2.1.2 LAST YEAR
2.1.3 APHORISMS
2.1.4 HELPING MYSELF AND OTHERS
2.1.5 GETTING HELP
2.1.6 MAKING AND KEEPING FRIENDS
2.1.7 TURNS
2.1.8 SCHOOL, TEACHER, FRIENDS, AND FAMILY
2.1.9 PREDICTIONS ABOUT TOMORROW
2.1.10 PLANNING FOR TOMORROW
2.1.11 THINKING
2.1.12 LIBRARY
2.1.13 CONCEPT AND SKILL INVENTORY

CLUSTER 2 TIME, WEATHER, AND SKY

2.2.1 TEMPERATURE
2.2.2 WIND
2.2.3 SUNRISE, SUNSET, AND SEASONS
2.2.4 MOONRISE AND MOONSET
2.2.5 RAIN
2.2.6 SNOW
2.2.7 DIGITAL TIME
2.2.8 ANALOG TIME

CLUSTER 3 ANIMALS

2.3.1 THE CLASSROOM AQUARIUM
2.3.2 EXTERNAL ANATOMY OF FISH
2.3.3 BIOLOGICAL NEEDS OF FISH
2.3.4 REPRODUCTION AND DEVELOPMENT OF FISH
2.3.5 FINDING INSECT EGGS
2.3.6 HATCHING INSECT EGGS
2.3.7 EARLY METAMORPHOSIS
2.3.8 LATE METAMORPHOSIS
2.3.9 COLLECTING SPIDERS
2.3.10 SPIDER FOOD
2.3.11 SPIDER CARE
2.3.12 SPIDERS AS PREDATORS
2.3.13 SPIDER WEBS
2.3.14 CLASSROOM PETS

CLUSTER 4 PLANTS

2.4.1 SOIL
2.4.2 MAKING SOIL
2.4.3 SOIL AND PLANTS
2.4.4 SOIL USES
2.4.5 FINDING SOIL
2.4.6 PIPES AND WATER
2.4.7 MOVING WATER
2.4.8 MOVING WATER WITH PUMPS
2.4.9 VEGETABLE GARDEN IN A BUCKET
2.4.10 FLOWER GARDEN IN A BUCKET
2.4.11 PLANTS AND SUNLIGHT
2.4.12 ROOTING STEMS
2.4.13 ROOTING BULBS AND TUBERS
2.4.14 ROOTS AND WATER
2.4.15 GROWING ROOT VEGETABLES
2.4.16 TREE PLANTING

CLUSTER 5 FOOD AND NUTRITION

2.5.1 SUPERMARKET SURVEY
2.5.2 FOOD PREFERENCES
2.5.3 BASIC THREE FOOD GROUPS
2.5.4 NEW FOODS
2.5.5 IDENTIFYING PROPERTIES OF VEGETABLES
2.5.6 CHANGING FLAVOR
2.5.7 MILK
2.5.8 BUTTER
2.5.9 CHEESE
2.5.10 ENERGY FROM FOOD

CLUSTER 6 HEALTH AND SAFETY

2.6.1 GROWTH CHART
2.6.2 TOOTH CHART
2.6.3 TOOTH CARE
2.6.4 GETTING HURT
2.6.5 GETTING SICK
2.6.6 STAYING WELL
2.6.7 CLASSROOM AND PLAYGROUND SAFETY
2.6.8 FIRE SAFETY
2.6.9 USING 911

CLUSTER 7 WAYFINDING AND TRANSPORTATION

2.7.1 TRANSPORTATION SYSTEMS
2.7.2 MAKING RACE CARS
2.7.3 RACING AND MODIFYING CARS
2.7.4 ROADS
2.7.5 BUILDING A VILLAGE
2.7.6 PEDESTRIANS IN THE VILLAGE
2.7.7 BIKES IN THE VILLAGE
2.7.8 CARS IN THE VILLAGE
2.7.9 BIKES AND TRIKES
2.7.10 BELTS AND PULLEYS
2.7.11 FAST AND SLOW PULLEYS
2.7.12 GEARS AND WHEELS

CLUSTER 8 ENERGY AND COMMUNICATION

2.8.1 CAMERA OBSCURA
2.8.2 MIRRORS AND SUNLIGHT
2.8.3 CLOUDS AND SUNLIGHT
2.8.4 COMPARING TEMPERATURES
2.8.5 ECLIPSES

CLUSTER 9 CONSERVATION, RECYCLING, AND DECOMPOSITION

2.9.1 FALL UNEARTHING
2.9.2 FALL BURYING
2.9.3 SPRING UNEARTHING
2.9.4 SPRING BURYING
2.9.5 POLLUTION SURVEY AND CLEANUP
2.9.6 ALUMINUM RECYCLING
2.9.7 CONNECTIONS

CLUSTER 10 MATTER, SPACE, AND CONSTRUCTION

2.10.1 DESK ORGANIZATION
2.10.2 NOTEBOOK ORGANIZATION
2.10.3 THE BALANCE
2.10.4 METER-STRING CAN
2.10.5 MEASURING VOLUME
2.10.6 SAFETY EQUIPMENT

DASH 3
ACTIVITY LIST

CLUSTER 1 LEARNING

3.1.1 THE LEARNING CALENDAR
3.1.2 LAST YEAR
3.1.3 RESPONSIBILITY
3.1.4 PLANNING
3.1.5 ORGANIZING OUR ENVIRONMENT
3.1.6 FRIENDS
3.1.7 GIVING AND RECEIVING
3.1.8 WORKING TOGETHER
3.1.9 HELPING MYSELF AND OTHERS
3.1.10 APHORISMS
3.1.11 NEXT YEAR
3.1.12 CAREY'S GARDEN
3.1.13 CONCEPT AND SKILL INVENTORY

CLUSTER 2 TIME, WEATHER, AND SKY

3.2.1 WEATHER
3.2.2 TEMPERATURE
3.2.4 WIND
3.2.5 RAIN AND SNOW
3.2.6 HUMIDITY
3.2.7 MOON PHASES
3.2.8 POLAR SKY MODEL
3.2.9 POLAR CONSTELLATIONS
3.2.10 VENUS
3.2.11 ECLIPSES

CLUSTER 3 ANIMALS

3.3.1 CLASSROOM PETS
3.3.2 PREPARING TO RAISE INSECTS
3.3.3 RAISING INSECTS
3.3.4 IMPORTANCE OF INSECTS
3.3.5 NATURAL HABITATS OF FROGS AND TOADS
3.3.6 MAKING HABITATS FOR FROGS AND TOADS
3.3.7 FROG METAMORPHOSIS
3.3.8 IMPORTANCE OF FROGS AND TOADS
3.3.9 TOADS AND INSECTS
3.3.10 HATCHING CHICKS
3.3.11 CHICK GROWTH
3.3.12 IMPORTANCE OF BIRDS

CLUSTER 4 PLANTS

3.4.1 GARDEN PLANNING
3.4.2 GARDEN PREPARATION
3.4.3 WATCHING GARDEN SOIL
3.4.4 MAKING ARTIFICIAL SOIL
3.4.5 TESTING ARTIFICIAL SOIL
3.4.6 SOIL AND WATER
3.4.7 GARDEN PLANTING
3.4.8 GARDEN CARE
3.4.9 GARDEN WATERING SYSTEMS
3.4.10 GARDEN INVADERS
3.4.11 CONTROLLING INSECTS
3.4.12 GARDEN HARVESTING
3.4.13 FLOWERS
3.4.14 SEEDS
3.4.15 POLLINATION

CLUSTER 5 FOOD AND NUTRITION

3.5.1 FOOD SELECTION
3.5.2 SELECTING PLANTS FOR THE GARDEN
3.5.3 PLANNING THE CLASS FEAST
3.5.4 PREPARING THE CLASS FEAST
3.5.5 THE CLASS FEAST
3.5.6 DRYING FOODS
3.5.7 PICKLING FOODS
3.5.8 PRESERVING AND ROTTING
3.5.9 SUPERMARKET GAME PREPARATION
3.5.10 PRICING FOODS
3.5.11 NEWSPAPER ADS AND BANKING
3.5.12 FARMERS AND PROCESSORS
3.5.13 SUPERMARKET GAME

CLUSTER 6 HEALTH AND SAFETY

3.6.1 GROWTH CHART
3.6.2 TOOTH CHART
3.6.3 BREATHING AIR
3.6.4 ANATOMY OF BREATHING
3.6.5 LUNG MODEL
3.6.6 LUNGS AND SMOKING
3.6.7 BREATHING AND PULSE RATES
3.6.8 HEART, VEINS, AND ARTERIES
3.6.9 HEART, LUNGS, AND EXERCISE
3.6.10 DISEASE TRANSMISSION
3.6.11 TRASH AND SANITATION
3.6.12 HELPFUL DRUGS
3.6.13 PROPER DRUG USE

CLUSTER 7 WAYFINDING AND TRANSPORTATION

3.7.1 GARDEN MOVER
3.7.2 PROPELLER-DRIVEN MESSAGE CENTER
3.7.3 PROPELLER-DRIVEN BOAT
3.7.4 DELIVERY SYSTEMS

CLUSTER 8 ENERGY AND COMMUNICATION

3.8.1 SHADOW, LIGHT, AND BUBBLES
3.8.2 WIND AND HEAT
3.8.3 WIND PULLS AND PUSHES
3.8.4 PROPELLERS DRIVING PROPELLERS
3.8.5 WATERWHEELS
3.8.6 PROPELLERS IN WATER
3.8.7 HELIOGRAPH
3.8.8 SPEAKING TUBE
3.8.9 STRING TELEPHONE
3.8.10 ENERGY DEFINITIONS

CLUSTER 9 CONSERVATION, RECYCLING, AND DECOMPOSITION

3.9.1 MAKING COMPOST
3.9.2 WATCHING COMPOST
3.9.3 ANIMALS IN COMPOST
3.9.4 USING COMPOST
3.9.5 FALL UNEARTHING AND BURIAL
3.9.6 SPRING UNEARTHING AND BURIAL

CLUSTER 10 MATTER, SPACE, AND CONSTRUCTION

3.10.1 ACIDIC AND BASIC SOIL
3.10.2 ACIDS AND BASES
3.10.3 ACID AND BASE REACTIONS
3.10.4 DILUTING ACIDS AND BASES
3.10.5 ACID AND BASE INTERACTION
3.10.6 DISSOLVING THINGS
3.10.7 THINGS IN LIQUIDS
3.10.8 CRYSTALS
3.10.9 RAIN IN A JAR
3.10.10 SUPERMARKET PLANNING
3.10.11 SUPERMARKET CONSTRUCTION
3.10.12 MEASURING DEVICES
3.10.13 SAFETY EQUIPMENT

DASH 4
ACTIVITY LIST

CLUSTER 1 LEARNING

4.1.1 THE LEARNING CALENDAR
4.1.2 RESPONSIBILITY
4.1.3 LAST YEAR
4.1.4 THE LIBRARY
4.1.5 WORKING TOGETHER
4.1.6 THINGS I CAN DO FOR MYSELF AND FOR OTHERS
4.1.7 APHORISMS
4.1.8 PLANNING
4.1.9 SURVIVAL GAME
4.1.10 CONCEPT AND SKILL INVENTORY

CLUSTER 2 TIME, WEATHER, AND SKY

4.2.1 RAINFALL
4.2.2 SNOWFALL
4.2.3 WIND DIRECTION
4.2.4 WIND SPEED
4.2.5 HEIGHT OF CLOUDS
4.2.6 HUMIDITY
4.2.7 CLOUDS AND WEATHER
4.2.8 STORM CLOUDS
4.2.9 LIGHTNING
4.2.10 WEATHER MAPS
4.2.11 WEATHER FRONTS
4.2.12 PREDICTING WEATHER
4.2.13 WIND CHILL
4.2.14 FLAT OR ROUND EARTH
4.2.15 LENGTH OF DAY AND NIGHT
4.2.16 THE SUN'S SHADOW PATH
4.2.17 PLANETARIUM
4.2.18 USING THE PLANETARIUM
4.2.19 PLANETS
4.2.20 WHEN IS IT NOON?
4.2.21 MAKING A SUNDIAL
4.2.22 USING A SUNDIAL
4.2.23 SEASONS AND THE SUN
4.2.24 MOON PHASES AND THE SUN
4.2.25 ECLIPSES

CLUSTER 3 ANIMALS

4.3.1 PET CARE
4.3.2 THE UNINCUBATED EGG
4.3.3 CHICK EMBRYOLOGY
4.3.4 RAISING SMALL MAMMALS
4.3.5 HOUSING PET MAMMALS
4.3.6 WEEKEND CARE OF PET MAMMALS
4.3.7 PAIRING PET MAMMALS
4.3.8 REPRODUCTION OF PET MAMMALS
4.3.9 PET BABY CARE
4.3.10 OUR EARLY YEARS
4.3.11 THE FIRST GRADE CHILD
4.3.12 GROWTH, DEVELOPMENT, AND BEHAVIOR OF YOUNG PETS
4.3.13 HUMAN GROWTH AND DEVELOPMENT
4.3.14 CHANGING DIMENSIONS
4.3.15 EXTERNAL ANATOMY OF FISH
4.3.16 CLEANING FISH: INTERNAL ANATOMY
4.3.17 FISH REPRODUCTION
4.3.18 MODELING OUR DIGESTIVE SYSTEM
4.3.19 OUR DIGESTIVE SYSTEM IN TWO DIMENSIONS
4.3.20 DIGESTIVE, CIRCULATORY, AND RESPIRATORY SYSTEMS
4.3.21 LENGTH OF THE DIGESTIVE TRACT
4.3.22 MIGRATION AND HIBERNATION
4.3.23 FALL BIRDS
4.3.24 WINTER BIRDS
4.3.25 SPRING BIRDS

CLUSTER 4 PLANTS

4.4.1 ANNUAL, BIENNIAL, AND PERENNIAL GARDEN PLANTS
4.4.2 THE FUNGUS AMONG US
4.4.3 FUNGUS COLLECTION

CLUSTER 5 FOOD AND NUTRITION

4.5.1 NUTRITION MESSAGES
4.5.2 MECHANICAL DIGESTION
4.5.3 CHEMICAL DIGESTION
4.5.4 FOOD GROUPS
4.5.5 DIGESTION GAME
4.5.6 PRESERVING FOODS

CLUSTER 6 HEALTH AND SAFETY

4.6.1 GROWTH CHART AND AREA MEASUREMENT
4.6.2 TOOTH CHART
4.6.3 SAFETY GEAR
4.6.4 SAFETY AND PUTTING OUT FIRES
4.6.5 MAKING A FIRE
4.6.6 THINGS THAT BURN
4.6.7 SMOKING AND THE LUNGS
4.6.8 ALCOHOL, TOBACCO, AND DRUGS

CLUSTER 7 WAYFINDING AND TRANSPORTATION

4.7.1 BOAT DESIGN
4.7.2 WIND AND SAILS

CLUSTER 8 ENERGY AND COMMUNICATION

4.8.1 PUSH-PULL MEASURING TOOL
4.8.2 FRICTION
4.8.3 STREAMLINING
4.8.4 PRESSURE, SHARP EDGES, AND POINTS
4.8.5 ENERGY OF FALLING OBJECTS
4.8.6 CIRCLES AND SPEED

CLUSTER 9 CONSERVATION, RECYCLING, AND DECOMPOSITION

4.9.1 UNEARTHING
4.9.2 RECYCLING PROJECT

CLUSTER 10 MATTER, SPACE, AND CONSTRUCTION

4.10.1 LINEAR MEASUREMENT
4.10.2 VOLUME MEASUREMENT
4.10.3 MASS MEASUREMENT
4.10.4 COLLECTING ROCKS
4.10.5 HARDNESS OF ROCKS
4.10.6 SPECIFIC GRAVITY
4.10.7 ROCKS AND SHARP EDGES
4.10.8 MAKING TOOLS FROM ROCK
4.10.9 MAKING FISHING TOOLS
4.10.10 CLOWNS: THINGS THAT FLOAT
4.10.11 CLAY
4.10.12 FIRE AND POTTERY
4.10.13 AIR AND FIRE
4.10.14 FIRE AND OXYGEN
4.10.15 PROPERTIES OF GASES

DASH 5
ACTIVITY LIST

CLUSTER 1 LEARNING

5.1.1 THE LEARNING CALENDAR
5.1.2 RESPONSIBILITY
5.1.3 LIBRARY CHECK-OUT
5.1.4 LIBRARY CHECK-IN
5.1.5 WORKING TOGETHER
5.1.6 THINGS I CAN DO FOR MYSELF AND OTHERS
5.1.7 APHORISMS
5.1.8 FRIENDSHIP
5.1.9 CONCEPT AND SKILL INVENTORY

CLUSTER 2 TIME, WEATHER, AND SKY

5.2.1 WEATHER STATION
5.2.2 HEAT INDEX
5.2.3 WEATHER AND ITS PREDICTION
5.2.4 CLOUDS AND FRONTS
5.2.5 TRIANGLES
5.2.6 GNOMON
5.2.7 SIZE OF THE EARTH
5.2.8 MOON THROUGH A TELESCOPE
5.2.9 HOW BIG AND FAR AWAY IS THE MOON?
5.2.10 PATHS OF CELESTIAL BODIES
5.2.11 MODELS OF THE SOLAR SYSTEM

CLUSTER 3 ANIMALS

5.3.1 PET CARE
5.3.2 BIRD FEEDER
5.3.3 BIRDS I KNOW
5.3.4 CELLS
5.3.5 CELL QUIZ
5.3.6 MALE UROGENITAL SYSTEM
5.3.7 FEMALE UROGENITAL SYSTEM
5.3.8 OVULATION CYCLE
5.3.9 OVULATION AND PREGNANCY
5.3.10 EMBRYOLOGY
5.3.11 BODY CHANGES
5.3.12 BONES
5.3.13 SKELETAL SYSTEM
5.3.14 MUSCLES
5.3.15 MUSCULAR SYSTEM
5.3.16 CHEMISTRY AND BONES
5.3.17 THE SENSES
5.3.18 THE EYE
5.3.19 SOUND
5.3.20 THE EAR

CLUSTER 4 PLANTS

5.4.1 ANNUAL, BIENNIAL, AND PERENNIAL PLANT PROJECT
5.4.2 TREE HARVESTING
5.4.3 TREE PLANTING
5.4.4 TREE OBSERVATION
5.4.5 MEASURING TREES
5.4.6 AGE OF TREES
5.4.7 TREES, SHRUBS, AND GRASSES
5.4.8 GRASSES: WHY DO THEY GROW THERE?
5.4.9 ROOTS
5.4.10 SOIL CONSERVATION

CLUSTER 5 FOOD AND NUTRITION

5.5.1 NUTRIENTS
5.5.2 NUTRIENTS AND CELLS
5.5.3 FOOD LABELING

CLUSTER 6 HEALTH AND SAFETY

5.6.1 GROWTH CHART AND AREA MEASUREMENT
5.6.2 TOOTH CHART
5.6.3 SAFETY DEVICES
5.6.4 ALCOHOL, TOBACCO, AND DRUGS
5.6.5 SEXUALLY TRANSMITTED DISEASES
5.6.6 SEXUALLY TRANSMITTED DISEASE QUIZ
5.6.7 TOBACCO QUIZ
5.6.8 SMOKERS' SURVEY
5.6.9 EX-SMOKERS' SURVEY
5.6.10 SMOKING LAWS
5.6.11 ALCOHOL QUIZ
5.6.12 ALCOHOL LAWS
5.6.13 CHRIS'S STORY
5.6.14 THE PARENTS' STORY
5.6.15 INTOXICATION
5.6.16 DRUG LAWS

CLUSTER 7 WAYFINDING AND TRANSPORTATION

5.7.1 WHERE IN THE WORLD ARE WE?
5.7.2 PLANETARIUM
5.7.3 MAPPING THE SKY
5.7.4 THE NORTH POLE, EQUATOR, AND ECLIPTIC
5.7.5 WHERE IS EARTH?

CLUSTER 8 ENERGY AND COMMUNICATION

5.8.1 PUSHES, PULLS, AND FORCES
5.8.2 TEETER-TOTTERS
5.8.3 THE BALANCE
5.8.4 WHEELS AND AXLES
5.8.5 LEVERS: WHERE ARE THEY?
5.8.6 ARMS AND JAWS
5.8.7 INCLINED PLANES AND SCREWS
5.8.8 BLOCK AND TACKLE
5.8.9 FORCES PROJECTS

CLUSTER 9 CONSERVATION, RECYCLING, AND DECOMPOSITION

5.9.1 CLASS RECYCLING PROJECT
5.9.2 CLASS CONSERVATION PROJECT
5.9.3 DECOMPOSITION AND ARCHEOLOGY
5.9.4 POLLUTION PROJECT

CLUSTER 10 MATTER, SPACE, AND CONSTRUCTION

5.10.1 LINEAR MEASUREMENT
5.10.2 VOLUME MEASUREMENT
5.10.3 CAMERA OBSCURA
5.10.4 CONTROLLING LIGHT WITH LENSES
5.10.5 MAKING A TELESCOPE
5.10.6 STABILIZING THE TELESCOPE
5.10.7 MAKING A MICROSCOPE
5.10.8 MAKING A HYGROMETER
5.10.9 MAKING A BAROMETER

DASH 6
ACTIVITY LIST

CLUSTER 1 LEARNING

6.1.1 THE LEARNING CALENDAR
6.1.2 MARS MISSION
6.1.3 LAST YEAR
6.1.4 TOMORROW
6.1.5 THE WORK WORLD
6.1.6 GOALS
6.1.7 CRASH SIMULATION
6.1.8 MARS COMPACT
6.1.9 MARTIAN SIMULATION
6.1.10 THE MISSION CONFERENCE
6.1.11 CONCEPT AND SKILL INVENTORY

CLUSTER 2 TIME, WEATHER, AND SKY

6.2.1 WEATHER STATION
6.2.2 WEATHER AROUND THE UNITED STATES
6.2.3 WEATHER AND LOCAL CLIMATE
6.2.4 WIND HYPOTHESES
6.2.5 PRODUCING WINDS
6.2.6 AIR PRESSURE AND ALTITUDE
6.2.7 WIND AND WATER
6.2.8 ALTITUDE AND TEMPERATURE
6.2.9 MODELS OF AIR
6.2.10 CLIMATIC REGIONS
6.2.11 CLIMATE OF MARS

CLUSTER 3 ANIMALS

6.3.1 ANIMAL CARE
6.3.2 RAISING FISH
6.3.3 RAISING WORMS
6.3.4 FOOD CHAINS

CLUSTER 4 PLANTS

6.4.1 HYDROPONICS
6.4.2 ALGAE
6.4.3 NUTRIENTS AND BIOLOGICAL WASTE
6.4.4 WATER POLLUTANTS

CLUSTER 5 FOOD AND NUTRITION

6.5.1 NUTRIENT INFORMATION
6.5.2 THE KILOCALORIE
6.5.3 WEIGHT WATCHING
6.5.4 MEAL PLANNING
6.5.5 FOOD FOR SPACE
6.5.6 FISH FOR DINNER

CLUSTER 6 HEALTH AND SAFETY

6.6.1 GROWTH CHART
6.6.2 TOOTH CHART
6.6.3 SAFETY DEVICES
6.6.4 DISEASE LITERATURE
6.6.5 SANITATION
6.6.6 DISEASE-PRODUCING ORGANISMS
6.6.7 SEXUALLY TRANSMITTED DISEASES
6.6.8 DRUG ABUSE: PREVENTION AND TREATMENT
6.6.9 ALCOHOL AND TOBACCO
6.6.10 ENVIRONMENTAL DISEASE: TRANSMISSION, PREVENTION, AND TREATMENT
6.6.11 EXERCISE AND HEALTH AND THE MARS MISSION

CLUSTER 7 WAYFINDING AND TRANSPORTATION

6.7.1 FLYING AIRPLANES
FLYING ROCKETS
6.7.3 SPACECRAFT
6.7.4 THE ORBIT OF MARS
6.7.5 WHAT PATH TO MARS?

CLUSTER 8 ENERGY AND COMMUNICATION

6.8.1 ROCKET PROPULSION
6.8.2 MAGNETISM
6.8.3 ELECTROSTATICS
6.8.4 ELECTRICAL CIRCUITS
6.8.5 ROCK FORMATION
6.8.6 METALS FROM ROCK
6.8.7 ASYMMETRICAL LEVER

CLUSTER 9 CONSERVATION, RECYCLING, AND DECOMPOSITION

6.9.1 CLASS RECYCLING PROJECT
6.9.2 CONSERVATION
6.9.3 DECOMPOSITION: A SUMMARY
6.9.4 POLLUTION

CLUSTER 10 MATTER, SPACE, AND CONSTRUCTION

6.10.1 MAKING MEASURING EQUIPMENT
6.10.2 MAKING BALANCES
6.10.3 MAKING AN ELECTROSCOPE
6.10.4 MAKING ELECTROMAGNETS AND CURRENT INDICATORS
6.10.5 MAKING ELECTRIC CELLS
6.10.6 MAKING AN ELECTRIC MOTOR
6.10.7 MAKING AN ELECTRIC SIGNALER
6.10.8 MAKING A SURVIVAL HABITAT

DASH K–6
CLUSTER OUTLINES

CLUSTER ONE - LEARNING

GRADE KINDERGARTEN

K.1.1 THE LEARNING CALENDAR
K.1.2 THE CLASS RESPONSIBILITY CHART
K.1.3 CALENDAR REVIEW
K.1.4 THE HOME LEARNING CALENDAR
K.1.5 THE SCIENCE RECORD BOOK
K.1.6 USING OUR SENSES
K.1.7 SAME AND DIFFERENT
K.1.8 PHYSICAL CHARACTERISTICS OF THINGS
K.1.9 FUNCTIONS OF THINGS
K.1.10 THE WORKING DICTIONARY AND WORKING DEFINITIONS
K.1.11 THE WONDER AND DISCOVER BOOK
K.1.12 THE CONNECTIONS BOOK
K.1.13 FAMILIES
K.1.14 FAMILIES AND HELPING
K.1.15 MAKING FRIENDS
K.1.16 BEING FRIENDS
K.1.17 SCHOOL AND HOME
K.1.18 CONCEPT AND SKILL INVENTORY

GRADE ONE

1.1.1 THE LEARNING CALENDAR
1.1.2 THE RESPONSIBILITY CHART
1.1.3 THE PLANNING CALENDAR
1.1.4 THING LEARNED LAST YEAR
1.1.5 HELPING
1.1.6 WORKING TOGETHER
1.1.7 TAKING TURNS AND SHARING
1.1.8 CONCEPT AND SKILL INVENTORY

GRADE TWO

2.1.1 THE LEARNING CALENDAR
2.1.2 LAST YEAR
2.1.3 APHORISMS
2.1.4 HELPING MYSELF AND OTHERS
2.1.5 GETTING HELP
2.1.6 MAKING AND KEEPING FRIENDS
2.1.7 TURNS
2.1.8 SCHOOL, TEACHER, FRIENDS, AND FAMILY
2.1.9 PREDICTIONS ABOUT TOMORROW
2.1.10 PLANNING FOR TOMORROW
2.1.11 THINKING
2.1.12 LIBRARY
2.1.13 CONCEPT AND SKILL INVENTORY

GRADE THREE

3.1.1 THE LEARNING CALENDAR
3.1.2 LAST YEAR
3.1.3 RESPONSIBILITY
3.1.4 PLANNING
3.1.5 ORGANIZING OUR ENVIRONMENT
3.1.6 FRIENDS
3.1.7 GIVING AND RECEIVING
3.1.8 WORKING TOGETHER
3.1.9 HELPING MYSELF AND OTHERS
3.1.10 APHORISMS
3.1.11 NEXT YEAR
3.1.12 CAREY'S GARDEN
3.1.13 CONCEPT AND SKILL INVENTORY

GRADE FOUR

4.1.1 THE LEARNING CALENDAR
4.1.2 RESPONSIBILITY
4.1.3 LAST YEAR
4.1.4 THE LIBRARY
4.1.5 WORKING TOGETHER
4.1.6 THINGS I CAN DO FOR MYSELF AND FOR OTHERS
4.1.7 APHORISMS
4.1.8 PLANNING
4.1.9 SURVIVAL GAME
4.1.10 CONCEPT AND SKILL INVENTORY

GRADE FIVE

5.1.1 THE LEARNING CALENDAR
5.1.2 RESPONSIBILITY
5.1.3 LIBRARY CHECK-OUT
5.1.4 LIBRARY CHECK-IN
5.1.5 WORKING TOGETHER
5.1.6 THINGS I CAN DO FOR MYSELF AND OTHERS
5.1.7 APHORISMS
5.1.8 FRIENDSHIP
5.1.9 CONCEPT AND SKILL INVENTORY

GRADE SIX

6.1.1 THE LEARNING CALENDAR
6.1.2 MARS MISSION
6.1.3 LAST YEAR
6.1.4 TOMORROW
6.1.5 THE WORK WORLD
6.1.6 GOALS
6.1.7 CRASH SIMULATION
6.1.8 MARS COMPACT
6.1.9 MARTIAN SIMULATION
6.1.10 THE MISSION CONFERENCE
6.1.11 CONCEPT AND SKILL INVENTORY

CLUSTER TWO - TIME, WEATHER, AND SKY

GRADE KINDERGARTEN

K.2.1 WEATHER WATCH
K.2.2 BEGINNINGS
K.2.3 ENDINGS
K.2.4 DAY AND NIGHT
K.2.5 DAYS, WEEKS, AND MONTHS
K.2.6 MOON WATCH
K.2.7 MOON PHASES
K.2.8 SEASONS
K.2.9 CLOCKS AND CALENDARS

GRADE ONE

1.2.1 SKY AND WEATHER WATCH
1.2.2 RAIN AND STREAMS
1.2.3 SNOW AND STREAMS
1.2.4 THE DIGITAL CLOCK
1.2.5 HOURS AND MINUTES
1.2.6 TIME LINE
1.2.7 SUNRISE AND SUNSET
1.2.8 NIGHT AND DAY
1.2.9 THE SUN
1.2.10 THE SEASONS
1.2.11 MAKING A CLOCK
1.2.12 MOONRISE AND MOON SET

GRADE TWO

2.2.1 TEMPERATURE
2.2.2 WIND
2.2.3 SUNRISE, SUNSET, AND SEASONS
2.2.4 MOONRISE AND MOONSET
2.2.5 RAIN
2.2.6 SNOW
2.2.7 DIGITAL TIME
2.2.8 ANALOG TIME

GRADE THREE

3.2.1 WEATHER
3.2.2 TEMPERATURE
3.2.3 WIND
3.2.4 RAIN AND SNOW
3.2.5 HUMIDITY
3.2.6 SUNRISE AND SUNSET
3.2.7 MOON PHASES
3.2.8 POLAR SKY MODEL
3.2.9 POLAR CONSTELLATIONS
3.2.10 VENUS
3.2.11 ECLIPSES

GRADE FOUR

4.2.1 RAINFALL
4.2.2 SNOWFALL
4.2.3 WIND DIRECTION
4.2.4 WIND SPEED
4.2.5 HEIGHT OF CLOUDS
4.2.6 HUMIDITY
4.2.7 CLOUDS AND WEATHER
4.2.8 STORM CLOUDS
4.2.9 LIGHTNING
4.2.10 WEATHER MAPS
4.2.11 WEATHER FRONTS
4.2.12 PREDICTING WEATHER
4.2.13 WIND CHILL
4.2.14 FLAT OR ROUND EARTH
4.2.15 LENGTH OF DAY AND NIGHT
4.2.16 THE SUN'S SHADOW PATH
4.2.17 PLANETARIUM
4.2.18 USING THE PLANETARIUM
4.2.19 PLANETS
4.2.20 WHEN IS IT NOON?
4.2.21 MAKING A SUNDIAL
4.2.22 USING A SUNDIAL
4.2.23 SEASONS AND THE SUN
4.2.24 MOON PHASES AND THE SUN
4.2.25 ECLIPSES

GRADE FIVE

5.2.1 WEATHER STATION
5.2.2 HEAT INDEX
5.2.3 WEATHER AND ITS PREDICTION
5.2.4 CLOUDS AND FRONTS
5.2.5 TRIANGLES
5.2.6 GNOMON
5.2.7 SIZE OF EARTH
5.2.8 MOON THROUGH A TELESCOPE
5.2.9 HOW BIG AND FAR AWAY IS THE MOON?
5.2.10 PATHS OF CELESTIAL BODIES
5.2.11 MODELS OF THE SOLAR SYSTEM

GRADE SIX

6.2.1 WEATHER STATION
6.2.2 WEATHER AROUND THE UNITED STATES
6.2.3 WEATHER AND LOCAL CLIMATE
6.2.4 WIND HYPOTHESES
6.2.5 PRODUCING WINDS
6.2.6 AIR PRESSURE AND ALTITUDE
6.2.7 WIND AND WATER
6.2.8 ALTITUDE AND TEMPERATURE
6.2.9 MODELS OF AIR
6.2.10 CLIMATIC REGIONS
6.2.11 CLIMATE OF MARS

CLUSTER THREE - ANIMALS

GRADE KINDERGARTEN

K.3.1 APPROPRIATE PETS
K.3.2 CLASSROOM ANIMALS
K.3.3 CARING FOR CLASSROOM ANIMALS
K.3.4 LIVING, ONCE-LIVING, AND NOT-LIVING
K.3.5 ANIMALS AND PLANTS
K.3.6 ANIMAL ENVIRONMENTS
K.3.7 USES FOR ANIMALS
K.3.8 HOW BUGS WALK
K.3.9 PARTS OF BUGS
K.3.10 PARTS OF MAMMALS
K.3.11 PEOPLE
K.3.12 ANIMALS AND FOOD
K.3.13 ANIMALS AND WATER
K.3.14 ANIMALS AND AIR
K.3.15 ANIMAL WASTES
K.3.16 HOW ANIMALS KEEP WARM
K.3.17 HOW ANIMALS KEEP COOL
K.3.18 REAL OR IMAGINARY

GRADE ONE

1.3.1 LIVING AND NOT-LIVING THINGS
1.3.2 DEFINING LIVING AND NOT-LIVING THINGS
1.3.3 ANIMAL SURVEY
1.3.4 ANIMAL KEY
1.3.5 ANIMAL NEEDS
1.3.6 PLANNING TO RAISE A SMALL ANIMAL
1.3.7 BUILDING CAGES
1.3.8 METAMORPHOSIS
1.3.9 CLASSROOM PETS

GRADE TWO

2.3.1 THE CLASSROOM AQUARIUM
2.3.2 EXTERNAL ANATOMY OF FISH
2.3.3 BIOLOGICAL NEEDS OF FISH
2.3.4 REPRODUCTION AND DEVELOPMENT OF FISH
2.3.5 FINDING INSECT EGGS
2.3.6 HATCHING INSECT EGGS
2.3.7 EARLY METAMORPHOSIS
2.3.8 LATE METAMORPHOSIS
2.3.9 COLLECTING SPIDERS
2.3.10 SPIDER FOOD
2.3.11 SPIDER CARE
2.3.12 SPIDERS AS PREDATORS
2.3.13 SPIDER WEBS
2.3.14 CLASSROOM PETS

GRADE THREE

3.3.1 CLASSROOM PETS
3.3.2 PREPARING TO RAISE INSECTS
3.3.3 RAISING INSECTS
3.3.4 IMPORTANCE OF INSECTS
3.3.5 NATURAL HABITATS OF FROGS AND TOADS
3.3.6 MAKING HABITATS FOR FROGS AND TOADS
3.3.7 FROG METAMORPHOSIS
3.3.8 IMPORTANCE OF FROGS AND TOADS
3.3.9 TOADS AND INSECTS
3.3.10 HATCHING CHICKS
3.3.11 CHICK GROWTH
3.3.12 IMPORTANCE OF BIRDS

GRADE FOUR

4.3.1 PET CARE
4.3.2 THE UNINCUBATED EGG
4.3.3 CHICK EMBRYOLOGY
4.3.4 RAISING SMALL MAMMALS
4.3.5 HOUSING PET MAMMALS
4.3.6 WEEKEND CARE OF PET MAMMALS
4.3.7 PAIRING PET MAMMALS
4.3.8 REPRODUCTION OF PET MAMMALS
4.3.9 PET BABY CARE
4.3.10 OUR EARLY YEARS
4.3.11 THE FIRST GRADE CHILD
4.3.12 GROWTH, DEVELOPMENT, AND BEHAVIOR OF YOUNG PETS
4.3.13 HUMAN GROWTH AND DEVELOPMENT
4.3.14 CHANGING DIMENSIONS
4.3.15 EXTERNAL ANATOMY OF FISH
4.3.16 CLEANING FISH: INTERNAL ANATOMY
4.3.17 FISH REPRODUCTION
4.3.18 MODELING OUR DIGESTIVE SYSTEM
4.3.19 OUR DIGESTIVE SYSTEM IN TWO DIMENSIONS
4.3.20 DIGESTIVE, CIRCULATORY, AND RESPIRATORY SYSTEMS
4.3.21 LENGTH OF THE DIGESTIVE TRACT
4.3.22 MIGRATION AND HIBERNATION
4.3.23 FALL BIRDS
4.3.24 WINTER BIRDS
4.3.25 SPRING BIRDS

GRADE FIVE

5.3.1 PET CARE
5.3.2 BIRD FEEDER
5.3.3 BIRDS I KNOW
5.3.4 CELLS
5.3.5 CELL QUIZ
5.3.6 MALE UROGENITAL SYSTEM
5.3.7 FEMALE UROGENITAL SYSTEM
5.3.8 OVULATION CYCLE
5.3.9 OVULATION AND PREGNANCY
5.3.10 EMBRYOLOGY
5.3.11 BODY CHANGES
5.3.12 BONES
5.3.13 SKELETAL SYSTEM
5.3.14 MUSCLES
5.3.15 MUSCULAR SYSTEM
5.3.16 CHEMISTRY AND BONES
5.3.17 THE SENSES
5.3.18 THE EYE
5.3.19 SOUND
5.3.20 THE EAR

GRADE SIX

6.3.1 ANIMAL CARE
6.3.2 RAISING FISH
6.3.3 RAISING WORMS
6.3.4 FOOD CHAINS

CLUSTER FOUR - PLANTS

GRADE KINDERGARTEN

K.4.1	PLANT PARTS
K.4.2	PLANT ENVIRONMENTS
K.4.3	PLANT USES
K.4.4	GROWING BEAN SPROUTS
K.4.5	PLANTS AND WATER
K.4.6	GARDENING

GRADE ONE

1.4.1	PLANT IDENTIFICATION
1.4.2	PLANT SURVEY
1.4.3	PLANT PRESSING
1.4.4	PLANT KEY
1.4.5	PLANT NEEDS
1.4.6	PLANT LIFE CYCLE
1.4.7	EDIBLE PLANT PARTS
1.4.8	PLANT PARTS ANIMALS EAT

GRADE TWO

2.4.1	SOIL
2.4.2	MAKING SOIL
2.4.3	SOIL AND PLANTS
2.4.4	SOIL USES
2.4.5	FINDING SOIL
2.4.6	PIPES AND WATER
2.4.7	MOVING WATER
2.4.8	MOVING WATER WITH PUMPS
2.4.9	VEGETABLE GARDEN IN A BUCKET
2.4.10	FLOWER GARDEN IN A BUCKET
2.4.11	PLANTS AND SUNLIGHT
2.4.12	ROOTING STEMS
2.4.13	ROOTING BULBS AND TUBERS
2.4.14	ROOTS AND WATER
2.4.15	GROWING ROOT VEGETABLES
2.4.16	TREE PLANTING

GRADE THREE

3.4.1	GARDEN PLANNING
3.4.2	GARDEN PREPARATION
3.4.3	WATCHING GARDEN SOIL
3.4.4	MAKING ARTIFICIAL SOIL
3.4.5	TESTING ARTIFICIAL SOIL
3.4.6	SOIL AND WATER
3.4.7	GARDEN PLANTING
3.4.8	GARDEN CARE
3.4.9	GARDEN WATERING SYSTEMS
3.4.10	GARDEN INVADERS
3.4.11	CONTROLLING INSECTS
3.4.12	GARDEN HARVESTING
3.4.13	FLOWERS
3.4.14	SEEDS
3.4.15	POLLINATION

GRADE FOUR

4.4.1	ANNUAL, BIENNIAL, AND PERENNIAL GARDEN PLANTS
4.4.2	THE FUNGUS AMONG US
4.4.3	FUNGUS COLLECTION

GRADE FIVE

5.4.1	ANNUAL, BIENNIAL, AND PERENNIAL PLANT PROJECT
5.4.2	TREE HARVESTING
5.4.3	TREE PLANTING
5.4.4	TREE OBSERVATION
5.4.5	MEASURING TREES
5.4.6	AGE OF TREES
5.4.7	TREES, SHRUBS, AND GRASSES
5.4.8	GRASSES: WHY DO THEY GROW THERE?
5.4.9	ROOTS
5.4.10	SOIL CONSERVATION

GRADE SIX

6.4.1	HYDROPONICS
6.4.2	ALGAE
6.4.3	NUTRIENTS AND BIOLOGICAL WASTE
6.4.4	WATER POLLUTANTS

CLUSTER FIVE - FOOD AND NUTRITION

GRADE KINDERGARTEN

K.5.1	BEAN SPROUT SALAD
K.5.2	DRINKS
K.5.3	FLOUR AND BREAD
K.5.4	FAMILIAR FOODS
K.5.5	FAVORITE FOODS
K.5.6	NEW FOODS
K.5.7	SNACKS FROM THE GARDEN

GRADE ONE

1.5.1	BASIC THREE FOOD GROUPS
1.5.2	COOKING
1.5.3	MEASURING VOLUME

GRADE TWO

2.5.1	SUPERMARKET SURVEY
2.5.2	FOOD PREFERENCES
2.5.3	BASIC THREE FOOD GROUPS
2.5.4	NEW FOODS
2.5.5	IDENTIFYING PROPERTIES OF VEGETABLES
2.5.6	CHANGING FLAVOR
2.5.7	MILK
2.5.8	BUTTER
2.5.9	CHEESE
2.5.10	ENERGY FROM FOOD

GRADE THREE

3.5.1	FOOD SELECTION
3.5.2	SELECTING PLANTS FOR THE GARDEN
3.5.3	PLANNING THE CLASS FEAST
3.5.4	PREPARING THE CLASS FEAST
3.5.5	THE CLASS FEAST
3.5.6	DRYING FOODS
3.5.7	PICKLING FOODS
3.5.8	PRESERVING AND ROTTING
3.5.9	SUPERMARKET GAME PREPARATION
3.5.10	PRICING FOODS
3.5.11	NEWSPAPER ADS AND BANKING
3.5.12	FARMERS AND PROCESSORS
3.5.13	SUPERMARKET GAME

GRADE FOUR

4.5.1	NUTRITION MESSAGES
4.5.2	MECHANICAL DIGESTION
4.5.3	CHEMICAL DIGESTION
4.5.4	FOOD GROUPS
4.5.5	DIGESTION GAME
4.5.6	PRESERVING FOODS

GRADE FIVE

5.5.1	NUTRIENTS
5.5.2	NUTRIENTS AND CELLS
5.5.3	FOOD LABELING

GRADE SIX

6.5.1	NUTRIENT INFORMATION
6.5.2	THE KILOCALORIE
6.5.3	WEIGHT WATCHING
6.5.4	MEAL PLANNING
6.5.5	FOOD FOR SPACE
6.5.6	FISH FOR DINNER

CLUSTER SIX - HEALTH AND SAFETY

GRADE KINDERGARTEN

K.6.1 GROWTH CHART
K.6.2 TOOTH CHART
K.6.3 TOOTH CARE
K.6.4 EXERCISE
K.6.5 GERMS
K.6.6 WASHING HANDS
K.6.7 BATHROOMS AND BASINS
K.6.8 APRONS
K.6.9 FOUNTAINS AND FAUCETS
K.6.10 GETTING SICK
K.6.11 FEELING SICK
K.6.12 GOING TO THE DOCTOR
K.6.13 WHAT DOCTORS DO
K.6.14 GOING TO THE HOSPITAL
K.6.15 RAINCOATS
K.6.16 TESTING RAINCOATS
K.6.17 WET AND COLD
K.6.18 KEEPING WARM INDOORS
K.6.19 KEEPING COOL INDOORS
K.6.20 HAND AND FOOT PROTECTION
K.6.21 GETTING LOST

GRADE ONE

1.6.1 GROWTH CHART
1.6.2 TOOTH CHART
1.6.3 BRUSHING TEETH
1.6.4 CHEWING
1.6.5 AIR AND BREATHING
1.6.6 GETTING HURT
1.6.7 STAYING HEALTHY
1.6.8 SAFETY RULES

GRADE TWO

2.6.1 GROWTH CHART
2.6.2 TOOTH CHART
2.6.3 TOOTH CARE
2.6.4 GETTING HURT
2.6.5 GETTING SICK
2.6.6 STAYING WELL
2.6.7 CLASSROOM AND PLAYGROUND SAFETY
2.6.8 FIRE SAFETY
2.6.9 USING 911

GRADE THREE

3.6.1 GROWTH CHART
3.6.2 TOOTH CHART
3.6.3 BREATHING AIR
3.6.4 ANATOMY OF BREATHING
3.6.5 LUNG MODEL
3.6.6 LUNGS AND SMOKING
3.6.7 BREATHING AND PULSE RATES
3.6.8 HEART, VEINS, AND ARTERIES
3.6.9 HEART, LUNGS, AND EXERCISE
3.6.10 DISEASE TRANSMISSION
3.6.11 TRASH AND SANITATION
3.6.12 HELPFUL DRUGS
3.6.13 PROPER DRUG USE

GRADE FOUR

4.6.1 GROWTH CHART AND AREA MEASUREMENT
4.6.2 TOOTH CHART
4.6.3 SAFETY GEAR
4.6.4 SAFETY AND PUTTING OUT FIRES
4.6.5 MAKING A FIRE
4.6.6 THINGS THAT BURN
4.6.7 SMOKING AND THE LUNGS
4.6.8 ALCOHOL, TOBACCO, AND DRUGS

GRADE FIVE

5.6.1 GROWTH CHART AND AREA MEASUREMENT
5.6.2 TOOTH CHART
5.6.3 SAFETY DEVICES
5.6.4 ALCOHOL, TOBACCO, AND DRUGS
5.6.5 SEXUALLY TRANSMITTED DISEASES
5.6.6 SEXUALLY TRANSMITTED DISEASE QUIZ
5.6.7 TOBACCO QUIZ
5.6.8 SMOKERS' SURVEY
5.6.9 EX-SMOKERS' SURVEY
5.6.10 SMOKING LAWS
5.6.11 ALCOHOL QUIZ
5.6.12 ALCOHOL LAWS
5.6.13 CHRIS'S STORY
5.6.14 THE PARENTS' STORY
5.6.15 INTOXICATION
5.6.16 DRUG LAWS

GRADE SIX

6.6.1 GROWTH CHART
6.6.2 TOOTH CHART
6.6.3 SAFETY DEVICES
6.6.4 DISEASE LITERATURE
6.6.5 SANITATION
6.6.6 DISEASE-PRODUCING ORGANISMS
6.6.7 SEXUALLY TRANSMITTED DISEASES
6.6.8 DRUG ABUSE: PREVENTION AND TREATMENT
6.6.9 ALCOHOL AND TOBACCO
6.6.10 ENVIRONMENTAL DISEASE : TRANSMISSION, PREVENTION, AND TREATMENT
6.6.11 EXERCISE AND HEALTH AND THE MARS MISSION

CLUSTER SEVEN - WAYFINDING AND TRANSPORTATION

GRADE KINDERGARTEN

K.7.1	RIGHT AND LEFT
K.7.2	SUNRISE
K.7.3	SUNSET
K.7.4	NORTH AND SOUTH
K.7.5	HOME LOCATION
K.7.6	SIDEWALKS AND WALKWAYS
K.7.7	ROADS
K.7.8	TRAFFIC SIMULATION EQUIPMENT
K.7.9	TRAFFIC SIMULATION MAPPING
K.7.10	TRAFFIC SIMULATION RULES
K.7.11	CLASSROOM MAPPING

GRADE ONE

1.7.1	PACING
1.7.2	NORTH, SOUTH, EAST, AND WEST
1.7.3	HOME
1.7.4	MAP DISTANCE
1.7.5	MAKING A BOAT
1.7.6	MAKING A LAKE
1.7.7	THE GREAT REGATTA
1.7.8	FLOATING AND SINKING
1.7.9	DRAINING A LAKE

GRADE TWO

2.7.1	TRANSPORTATION SYSTEMS
2.7.2	MAKING RACE CARS
2.7.3	RACING AND MODIFYING CARS
2.7.4	ROADS
2.7.5	BUILDING A VILLAGE
2.7.6	PEDESTRIANS IN THE VILLAGE
2.7.7	BIKES IN THE VILLAGE
2.7.8	CARS IN THE VILLAGE
2.7.9	BIKES AND TRIKES
2.7.10	BELTS AND PULLEYS
2.7.11	FAST AND SLOW PULLEYS
2.7.12	GEARS AND WHEELS

GRADE THREE

3.7.1	GARDEN MOVER
3.7.2	PROPELLER-DRIVEN MESSAGE CENTER
3.7.3	PROPELLER-DRIVEN BOAT
3.7.4	DELIVERY SYSTEMS

GRADE FOUR

4.7.1	BOAT DESIGN
4.7.2	WIND AND SAILS

GRADE FIVE

5.7.1	WHERE IN THE WORLD ARE WE?
5.7.2	PLANETARIUM
5.7.3	MAPPING THE SKY
5.7.4	THE NORTH POLE, EQUATOR, AND ECLIPTIC
5.7.5	WHERE IS EARTH?

GRADE SIX

6.7.1	FLYING AIRPLANES
6.7.2	FLYING ROCKETS
6.7.3	SPACECRAFT
6.7.4	THE ORBIT OF MARS
6.7.5	WHAT PATH TO MARS?

CLUSTER EIGHT - ENERGY AND COMMUNICATION

GRADE KINDERGARTEN

K.8.1	ENERGY
K.8.2	MAKING THINGS MOVE
K.8.3	MAKING THINGS STOP
K.8.4	TURNING THINGS OFF
K.8.5	TURNING THINGS ON
K.8.6	REPAIRING THINGS

GRADE ONE

1.8.1	TEMPERATURE OF THINGS
1.8.2	THE MASTER THERMOMETER
1.8.3	HOT AND COLD
1.8.4	SOURCES OF ENERGY

GRADE TWO

2.8.1	CAMERA OBSCURA
2.8.2	MIRRORS AND SUNLIGHT
2.8.3	CLOUDS AND SUNLIGHT
2.8.4	COMPARING TEMPERATURES
2.8.5	ECLIPSES

GRADE THREE

3.8.1	SHADOW, LIGHT, AND BUBBLES
3.8.2	WIND AND HEAT
3.8.3	WIND PULLS AND PUSHES
3.8.4	PROPELLERS DRIVING PROPELLERS
3.8.5	WATERWHEELS
3.8.6	PROPELLERS IN WATER
3.8.7	HELIOGRAPH
3.8.8	SPEAKING TUBE
3.8.9	STRING TELEPHONE
3.8.10	ENERGY DEFINITIONS

GRADE FOUR

4.8.1	PUSH-PULL MEASURING TOOL
4.8.2	FRICTION
4.8.3	STREAMLINING
4.8.4	PRESSURE, SHARP EDGES, AND POINTS
4.8.5	ENERGY OF FALLING OBJECTS
4.8.6	CIRCLES AND SPEED

GRADE FIVE

5.8.1	PUSHES, PULLS, AND FORCES
5.8.2	TEETER-TOTTERS
5.8.3	THE BALANCE
5.8.4	WHEELS AND AXLES
5.8.5	LEVERS: WHERE ARE THEY?
5.8.6	ARMS AND JAWS
5.8.7	INCLINED PLANES AND SCREWS
5.8.8	BLOCK AND TACKLE
5.8.9	FORCES PROJECTS

GRADE SIX

6.8.1	ROCKET PROPULSION
6.8.2	MAGNETISM
6.8.3	ELECTROSTATICS
6.8.4	ELECTRICAL CIRCUITS
6.8.5	ROCK FORMATION
6.8.6	METALS FROM ROCK
6.8.7	ASYMMETRICAL LEVER

CLUSTER NINE - CONSERVATION, RECYCLING AND DECOMPOSITION

GRADE KINDERGARTEN

K.9.1 DECOMPOSITION
K.9.2 WASTE DISPOSAL
K.9.3 RECYCLING PROJECT
K.9.4 MAKING PAPER

GRADE ONE

1.9.1 CONSERVING CLASSROOM RESOURCES
1.9.2 CONSERVING ENERGY
1.9.3 CONSERVING WATER
1.9.4 DECOMPOSITION AND UNEARTHING
1.9.5 DECOMPOSITION AND REBURIAL
1.9.6 RECYCLING

GRADE TWO

2.9.1 FALL UNEARTHING
2.9.2 FALL BURYING
2.9.3 SPRING UNEARTHING
2.9.4 SPRING BURYING
2.9.5 POLLUTION SURVEY AND CLEANUP
2.9.6 ALUMINUM RECYCLING
2.9.7 CONNECTIONS

GRADE THREE

3.9.1 MAKING COMPOST
3.9.2 WATCHING COMPOST
3.9.3 ANIMALS IN COMPOST
3.9.4 USING COMPOST
3.9.5 FALL UNEARTHING AND BURIAL
3.9.6 SPRING UNEARTHING AND BURIAL

GRADE FOUR

4.9.1 UNEARTHING AND BURIAL
4.9.2 RECYCLING PROJECT

GRADE FIVE

5.9.1 CLASS RECYCLING PROJECT
5.9.2 CLASS CONSERVATION PROJECT
5.9.3 DECOMPOSITION AND ARCHEOLOGY
5.9.4 POLLUTION PROJECT

GRADE SIX

6.9.1 CLASS RECYCLING PROJECT
6.9.2 CONSERVATION
6.9.3 DECOMPOSITION: A SUMMARY
6.9.4 POLLUTION

CLUSTER TEN - MATTER SPACE, AND CONSTRUCTION

GRADE KINDERGARTEN

K.10.1	CUBBY ORGANIZATION
K.10.2	PATTERNS IN PUZZLES
K.10.3	MAKING PUZZLES
K.10.4	MAKING ENVELOPES
K.10.5	MAKING BOXES AND BAGS
K.10.6	VOLUME OF BOXES AND BAGS
K.10.7	PACKING AND STORING
K.10.8	LINEAR MEASUREMENT

GRADE ONE

1.10.1	METER-STRING CAN
1.10.2	OUTDOOR STUDY AREA MAPPING
1.10.3	TESTING FOR WATER
1.10.4	PLUMBING
1.10.5	WATER SYSTEMS
1.10.6	AIR
1.10.7	BUBBLES IN WATER
1.10.8	BUBBLES IN AIR
1.10.9	BUILDING WITH AIR
1.10.10	FLOOR PLAN
1.10.11	FLOOR PLAN MODEL
1.10.12	CARDBOARD HOUSE PLAN
1.10.13	MAKING A CARDBOARD HOUSE
1.10.14	PAINTING THE HOUSE
1.10.15	FURNISHING THE HOUSE
1.10.16	SEWING
1.10.17	WEAVING
1.10.18	WARMING AND COOLING THE HOUSE
1.10.19	LIGHTING THE HOUSE
1.10.20	SAFETY EQUIPMENT

GRADE TWO

2.10.1	DESK ORGANIZATION
2.10.2	NOTEBOOK ORGANIZATION
2.10.3	THE BALANCE
2.10.4	METER-STRING CAN
2.10.5	MEASURING VOLUME
2.10.6	SAFETY EQUIPMENT

GRADE THREE

3.10.1	ACIDIC AND BASIC SOIL
3.10.2	ACIDS AND BASES
3.10.3	ACID AND BASE REACTIONS
3.10.4	DILUTING ACIDS AND BASES
3.10.5	ACID AND BASE INTERACTION
3.10.6	DISSOLVING THINGS
3.10.7	THINGS IN LIQUIDS
3.10.8	CRYSTALS
3.10.9	RAIN IN A JAR
3.10.10	SUPERMARKET PLANNING
3.10.11	SUPERMARKET CONSTRUCTION
3.10.12	MEASURING DEVICES
3.10.13	SAFETY EQUIPMENT

GRADE FOUR

4.10.1	LINEAR MEASUREMENT
4.10.2	VOLUME MEASUREMENT
4.10.3	MASS MEASUREMENT
4.10.4	COLLECTING ROCKS
4.10.5	HARDNESS OF ROCKS
4.10.6	SPECIFIC GRAVITY
4.10.7	ROCKS AND SHARP EDGES
4.10.8	MAKING TOOLS FROM ROCK
4.10.9	MAKING FISHING TOOLS
4.10.10	CLOWNS:THINGS THAT FLOAT
4.10.11	CLAY
4.10.12	FIRE AND POTTERY
4.10.13	AIR AND FIRE
4.10.14	FIRE AND OXYGEN
4.10.15	PROPERTIES OF GASES

GRADE FIVE

5.10.1	LINEAR MEASUREMENT
5.10.2	VOLUME MEASUREMENT
5.10.3	CAMERA OBSCURA
5.10.4	CONTROLLING LIGHT WITH LENSES
5.10.5	MAKING A TELESCOPE
5.10.6	STABILIZING THE TELESCOPE
5.10.7	MAKING A MICROSCOPE
5.10.8	MAKING A HYGROMETER
5.10.9	MAKING A BAROMETER

GRADE SIX

6.10.1	MAKING MEASURING EQUIPMENT
6.10.2	MAKING BALANCES
6.10.3	MAKING AN ELECTROSCOPE
6.10.4	MAKING ELECTROMAGNETS AND CURRENT INDICATORS
6.10.5	MAKING ELECTRIC CELLS
6.10.6	MAKING AN ELECTRIC MOTOR
6.10.7	MAKING AN ELECTRIC SIGNALER
6.10.8	MAKING A SURVIVAL HABITAT

DASH

GRADE 3

MATERIALS LIST

DASH Grade 3 Equipment and Supplies

Classroom Supplies

Consumable

Brass fasteners, 30, 1/2"
Bulldog clamps, 2", 2-3/group
Chart paper, plain and 1" grid
Construction paper, asstd.
Crayons or colored pencils
Glue, white and Post-it
Index cards, 5" X 8" & 3" X 5", asstd.
Markers, asstd. colors, washable
Markers, waterproof, asstd. & very fine line
Oak tag, chart size
Pencils
Paint, tempra, asstd. w/ brushes (opt.)
Paperclips, large, 1 box
Pushpins
Rubberbands, thick and thin, asstd.
Rulers, in. & cm
Staples
Straight pins, 1 pkg.
String, asstd.
String, heavy cord preferred (11-20m / group)
Tapes, masking, cellophane
Thumbtacks, 1 pkg.

Permanent

Clock, classroom (analog)
Meterstick or tape, 2-8, (1 required)
Paper punch, single hole
Scissors, heavy duty (universal or bandage)
Scissors, student
Staplers

Consumable Supplies (Discount Department Store or Grocery Store)

Baking soda, 1 med. box
Balloons, small, 1 pkg.
Beads, plastic crow, 1 pkg.
Candles, votive, 1/group
Canning jar lids (flat) inserts, small, 2-3 boxes
Cheesecloth, 1 pkg.
Chenille stems , 1 pkg, (opt.)
Chopsticks, 1 pkg.
Clothespins, wood, spring, 1-2/student
Crackers, soda 2-3/student
Craft sticks, wood, large, 1 pkg.
Cups, styrofoam, 25-50
Dish detergent (Dawn or Joy), 8 oz.
Dowel or stick, 1/4" diam., 24" long, 1-2
Drink mix, liquid/syrup, concentrated
Electric dishwasher soap, liquid, 8oz.
Foil, aluminum, 1 roll
Food coloring
Forks and spoons, plastic (25-30 each)
Gelatin, unflavored, 4-6 envelopes, 1 box
Gloves, plastic
Lemon or lime juice, 1 small bottle, 8 oz.
Matches, safety
Nails, asstd.
Nail, iron or fat needles
Nails, iron, asstd.
Paper plates, 8-12" diam, 2/student
Paper plates, thick, plain, 8-12", 40-50
Paper towels, 2-4 rolls
Pet supplies
Pie or cake pans, aluminum, 1-2 pkg.
Plastic bags, 1 qt., heavy freezer, 20-30
Plastic bags, sandwich size, resealable, 100
Plastic bags, resealable, asstd. sizes
Plastic bags, large, 2-3/student, (colors opt.)
Plastic cups, clear, soft, 9-10 oz., 50-75
Plastic or paper cups, 3 oz., 1-2/student
Plastic wrap, 1 roll.
Salt, 1 box
Seeds, radish, asstd. for garden
Skewers, wood, 1 pkg.
Straws, plastic, 1 box
Sugar, 1-2 lbs.
Tape, duct, 6-8 rolls
Tapes, asstd. colored plastic (opt.)
Thread, carpet or other heavy, 1 spool
Toothpicks, 1 box
Upholstery tacks, flat heads, 2-3 pkgs.
Vinegar, white, 1 qt.
Wire, heavy floral or other stiff, 1 pkg.

Permanent Supplies*

Aquarium (for tadpoles)
Calculators (opt.)
Cooking & food preparation equipment, asstd.
Centigram cubes or other metric mass wts.
  & other small objects for weighing, eg.
  paperclips, marbles, beads, etc.
Dishpans, buckets or large bowls, 4-6
Drill, electric w/ 1/2" bit
Eyedroppers (opt.)
Fan, electric
Fan, small battery (opt.)
Filmstrip or slide projector
Flashlights, w/ batteries, 2-4
Funnels, 4-6, small metal or plastic
Garden hose
Garden tools, asstd.
Goggles (opt.)
Hand lenses, 1/2 students
Hand tools for student use, asstd.
Human torso (opt.)
Hot water source
Ice source
Incubator
Lake materials: preformed wading pool or
  Large, heavy duty plastic cloth, 9'X12' or
  larger, shower curtain, tarp, drop cloth
  Boards: 2"X 6" or 8"X 3' (2 ea.) & X 6' (2ea)
Lamp, small w/ shade
Magnetic compass (opt.)
Magnets (opt.)
Mirrors, small, 8-12
Overhead projector
Puppets, animal or others (opt.)
Scale, bathroom
Stethoscope (opt.)
Stopwatch (opt.)
Syringe, large plastic (no needle), (opt.)
Thermometers, small, 8-12, w/ °C & °F
Trash can, plastic, 30 gal. or larger
Trouble light & cord, 15-20 watt bulb

***Many of these items can be borrowed or shared within a school.**

Recycled Materials

Aluminum pie pans and asstd. containers
Bags, paper, plastic, asstd. sizes
Boxes, corrugated cardboard, asstd.
Canning jars, 2-4, w/ lids, pt. or qt.
Cans, metal, gal. (w/lids) & other asstd.
Cans, other containers, straight-sided
Cardboard milk or juice cartons, asstd. sizes
Corks
Fabric scraps
Film canisters, clear
Food containers, clean, empty, all kinds,
  with labels
Hangers, thin metal
Jars, gal.,qt., baby food, and other asstd.
Lids, metal and plastic, asstd.
Magazines with colored pictures
Newspapers
Nylon stockings
Paint, latex, asstd. (opt.)
Plastic containers, other asstd.,
  some matched pairs
Screening, fiberglass
Seed packets, vegetable, empty, asstd.
Socks
Soda bottles, 1-3L, other asstd.
Styrofoam, asstd. pieces and containers
Tubes, cardboard, asstd.
Wire, asstd.
Wire, chicken
Wood scraps, asstd.wood dowel pieces (1/4")
Yarn and other astd. craft supplies

Special Purchase	Other
Almanac, current year or internet/ daily newspaper/phone access Bromothymol blue solution or builders lime, CaO, 1 cup Calendar paper-24" roll or computer Calendar, 1 year on a page (opt.) Cobalt Chloride paper, 1 vial Copper sulfate (opt.) Epsom salts or alum for crystals (opt.) Hydroin or pH paper, wide scale, 1 vial Pet, cage, and supplies Thermometer,large, w/ °C & °F Tubing, clear plastic, asstd. sizes and lengths	Bleach (small amt.) Chick mash Cigarettes, nonfiltered, 4-6 Fertile eggs Fertilizer, dry, all-purpose, small amt. Flowers Foods (usually requested from students) Plant bulbs and tubers (1-2 each) Plant cuttings Propeller toy (opt.) Reference Books: insects, birds, frogs & toads Tee-shirts, black or dark colored, 1/group Tadpoles

DASH

GRADE 3

COMPLEMENTARY MATERIALS

DASH
ON
HOME

3

University of Hawai'i • College of Education
Curriculum Research & Development Group
Science Projects
1776 University Avenue • Honolulu, Hawai'i 96822
Telephone: (808) 956-6918 • (800) 799-8111
Fax: (808) 956-4933 • (808) 956-4114

May 9, 1996

Dear *DASH* Teacher:

DASH holds to the notion that the study of science and technology should not be limited to the four walls of the classroom. Scientific and technological ways of knowing and doing are applicable in any part of the student's 24-hour day, and the aid of parents and others can help extend the experience of the student. The *DASH on HOME* newsletters are provided as a supplement to the *DASH* materials. Use them if they fit your needs.

Dr. Ann Baldwin Taylor of Carnegie Mellon University has headed a project to produce a series of *DASH on Home* newsletters for parents. Copies of these along with a letter of explanation follow. The newsletters are designed to provide your parents with extensional *DASH*-like activities that can be done in the home as parent-child inquiries. Though formatted formally, they can be cut up and reassembled in any way that meets your needs. Enclosed in this packet you will find

1. Copies of the ***DASH on Home*** family newsletters for you to copy and send to families as needed.
2. A "Dear Family" letter which you may want to use to introduce the newsletters to families. (Copy or write your own letter.)

Hints for successful use of ***DASH on Home***

1. To let families know what to expect from the newsletters, we have enclosed a "Dear Family" letter that can be sent home with the first newsletter.
2. Talk with your students before sending any newsletters home. You may want to discuss the topics and ask the children to let you know about the activities that are completed at home. You may want to ask your children to bring reports and projects back to share with the group.
3. Familiarize yourself with each newsletter so that you can have discussions and answer questions from parents and children as they are doing activities at home.
4. You will have two newsletters for your grade. We recommend sending one home in the Fall and one in the Spring.
5. Some teachers have found that including personalized information on an additional newsletter page has been very successful. By adding names, pictures, local maps, or school logos, ***DASH on Home*** becomes your own. The "sample personalized newsletter page" in this folder may give you ideas.

Sincerely,

Francis M. Pottenger III, Director

DASH
A Science, Health, & Technology Program
An NDN Developer/Demonstrator Project

Dear Family,

Twice during the school year I will be sending a family newsletter, ***DASH on Home*** with your child. These newsletters have been developed to accompany the Developmental Approaches in Science and Health Program which we are using in school. We are hoping that doing science, health and technolgy activities outside of school will help your child understand that these topics are part of everyday life.

Here are some hints to make these newsletters fun for your family.

- The whole family can get involved, caregivers, brothers, sisters and grandparents can help children with suggested activities.
- Select items which are appropriate for your child now. Begin with the activities which are more interesting to your child.
- You or your child may think of activities or experiments which will extend those that are suggested in the newsletter. For example; collecting stones or leaves may grow into a year round project.
- If your child is interested in a particular topic, don't forget about your local library as a resource. Your library will have many books about topics your child maybe interested in. Your child may want to share the books with his teacher and classmates.
- I realize that family members are busy, so don't worry about completing all of the suggested activities in the newsletter. You may want to save the newsletters to do some of the activities later.

I hope you enjoy helping your child learn with the ***DASH on Home*** newsletters.

Sincerely,

SAMPLE OF HOW YOU CAN "PERSONALIZE" AN ADDITIONAL PAGE TO A NEWSLETTER

DASH NEWS from ROOM 10

Display a child's drawing of a class pet here.

Remember to give credit to the child artist.

OUR NEW PET Our class has a "new" student. It is a Russian Dwarf Hamster. Rm. 10 has named its new friend Bella. She resides in her very own clear plastic house (which makes it easy to observe her actions). There are separate areas for eating, exercising and sleeping. We'll tell you more about Bella in the next newsletter.

A FEAST FIT FOR A KING!

Our class at All American Elementary School enjoyed a delicious ending to their study of food and teeth. A first annual Friendship Luncheon was prepared and cooked by the kindergarten students under the supervision of DASH teachers Mrs. Smith and Miss Jones. In coordination with the DASH food cluster, students listened to and dramatized the story, "Stone Soup, " and then prepared their own version in the classrooms. They also made homemade butter, peanut butter and fruit salad. With much help from parents, the students wearing their own apron creations, made individual loaves of bread. All of these nutritious items were part of a feast during a sit-down lunch at school. Parents became the waitresses and busboys to add the final touch to a super and filling lunch!

Be sure to include the children's and parent's names to the story .

Be sure to use a child's drawing here and give the artist credit.

SPRING HAS BLOOMED AT OUR SCHOOL!

The bulbs which the children planted in the fall are adding a colorful touch to the playground! We would like to keep the garden colorful through the summer months. In order to do this, we need top soil. The children have planted marigolds indoors and are almost ready to transplant them to the area around the flag pole. If we could put a layer of top soil down our plants would have a better chance of survival. If you can help us, please give the school a call- 555-5555. Thank you!

DASH
DEVELOPMENTAL APPROACHES IN SCIENCE AND HEALTH
ON HOME

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ACTIVITIES FOR FAMILIES VOLUME 3, NUMBER 1

DASH

This newsletter has been designed for the *Developmental Approaches in Science and Health* (DASH) curriculum that is being used in your child's school. DASH is a new curriculum for kindergarten through sixth grade. DASH connects science, health and technology subjects into all aspects of the school program.

You can bring "DASH on home" by helping your child with these activities. This newsletter will give you some ideas. Save the newsletters and take your time with them.

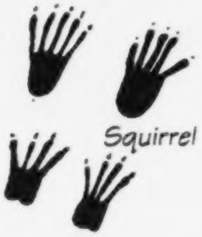
DASH has several units, called "clusters." The activities in this newsletter complement several DASH clusters. Look for **bold letters** to indicate the DASH ideas.

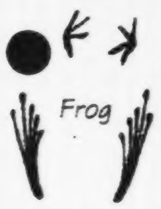
If you have any questions or comments about *DASH on Home*, please contact: DASH c/o The Children's School, Carnegie Mellon University, MMCC 17, Pittsburgh, PA 15213.

ONE OF THE THINGS YOUR CHILD IS LEARNING THROUGH DASH IS THE IMPORTANCE OF KEEPING RECORDS. YOUR CHILD'S CLASS HAS BEEN KEEPING RECORDS OF WEATHER, MOON PHASES, SEASONAL CHANGES AND CLASS EXPERIMENTS. NATURE HAS ITS OWN WAY OF LEAVING RECORDS THAT WE CAN READ. LOOK FOR NATURE'S RECORDS WITH YOUR CHILD.

RECORDS IN DUST, MUD AND SNOW

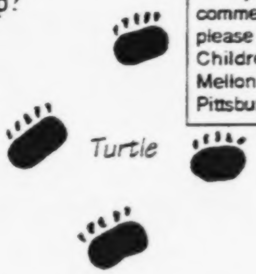
The world around us is full of records that tell us what has happened in the past. Dust, mud and snow provide fascinating records. Can you and your child find animal tracks, footprints and tire tracks? Are there things about the impression from a shoe that tell you what kind of shoe it is (child's running shoe, high heel, a man's boot) or who made it? Can you tell where cars have turned or backed up?

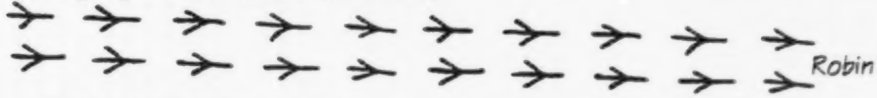




Become "trackers" and follow footprints of people or animals. What direction were they going? Where did they seem to go? Did they stop? Were they running or walking? Were they alone or in a group?

Another place to look for tracks is near water. Look for footprints on the concrete around swimming pools. Can you tell which tracks were made by right feet and which by left feet? Look for differences in the size and shape of footprints. Where else might you find tracks? **(Animals)**

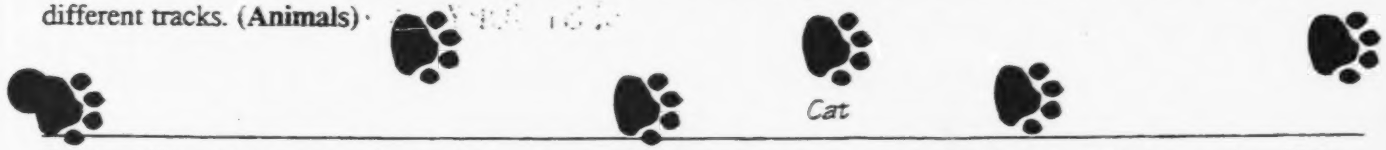




TRACK TRAPS

Make a "track trap" with your child. In wet or snowy weather, use a mud puddle or stretch of fresh snow. In dry weather, spread flour or baking soda on a hard surface to make a circle about a yard (or a meter) wide. Put some kind of bait in the center. Vegetables, fruit, nuts, popcorn or birdseed all make good bait. Leave the trap overnight and then come back in the morning and see what kinds of tracks have been left.

How many of the tracks can you identify? Try your trap again with a different kind of bait and see if you get different tracks. **(Animals)**



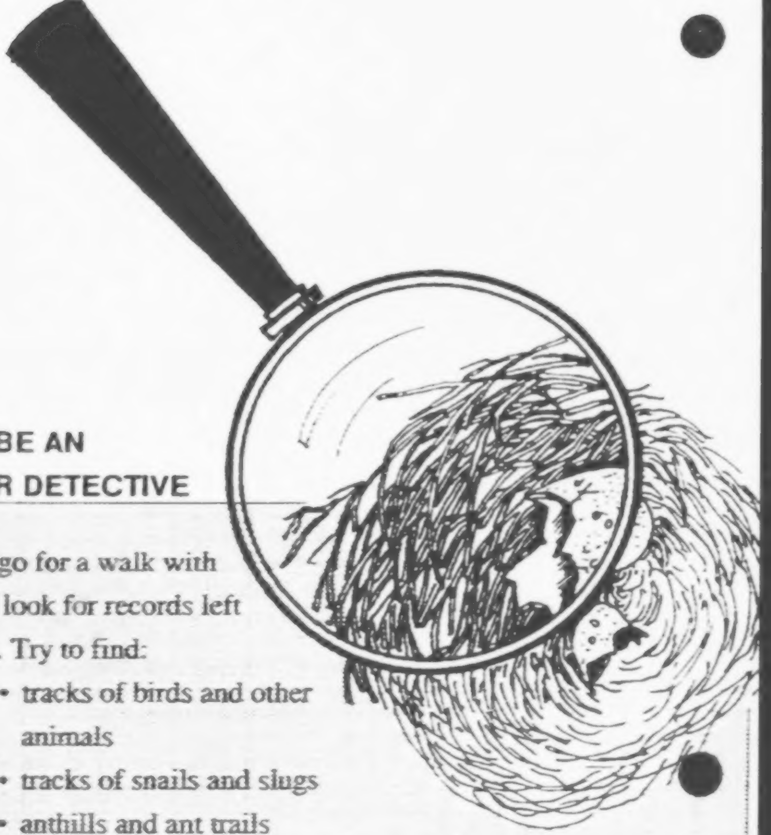
Suggestion: Paying attention to these records of nature can increase your child's power of observation. Help your child keep in mind that science means observing and trying to find meaning in what you see.

VOLUME 3, NUMBER 1

TRACKS OF WATER AND ROCKS

Streams, rain, oceans and even rocks leave records. The next time it rains, go outdoors with your child and watch the rain fall on the freshly exposed soil of a garden or a construction site. Watch what happens. Can you see the impact of a single drop, the path of a streamlet? Go back after the rain stops and look for records of what you saw. Can you find similar records in other places?

When you and your child are near a river, look for records of high-water marks. Can you find deposits of mud where the water was calm? Pebbles and rocks where it ran fast? At the beach, look for sticks and other debris that record the water's earlier heights.



HOW TO BE AN OUTDOOR DETECTIVE

When you go for a walk with your child, look for records left by animals. Try to find:

- tracks of birds and other animals
- tracks of snails and slugs
- anthills and ant trails
- cobwebs
- chewed or rubbed tree bark
- beehives and wasp nests
- animal droppings
- animal holes
- eggshells
- bird and squirrel nests

When your child can identify some of these signs of animals, take a silent nature walk. Concentrate on looking and listening. Try to see the animals *before* they see you. **(Animals)**

BEST COPY AVAILABLE

The next time you are driving, look for signs of landslides and rockfall along the highway. Try to trace their paths. **(Time, Weather and Sky; Energy and Communication)**

DASH
DEVELOPMENTAL APPROACHES IN SCIENCE AND HEALTH
ON HOME
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ACTIVITIES FOR FAMILIES
VOLUME 3, NUMBER 2

DASH

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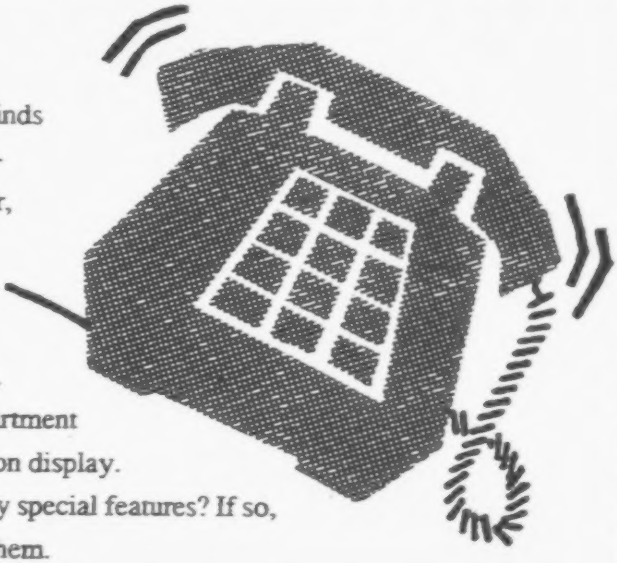
TECHNOLOGY IS ALL AROUND US, WAITING TO BE EXPLORED. BEING ABLE TO USE TELEPHONES, TELL TIME AND USE APPLIANCES ARE YOUR CHILD'S FIRST STEPS INTO THE WORLD OF TECHNOLOGY.

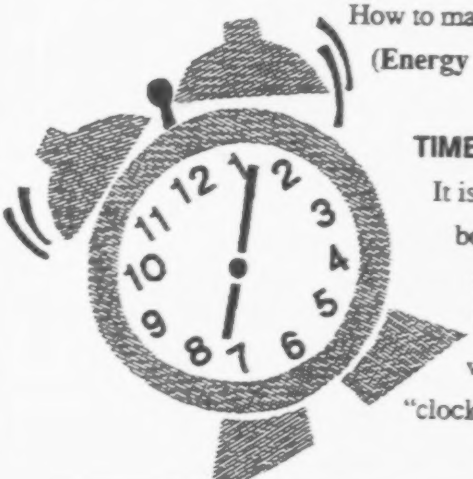
TELEPHONE DISCOVERY



Today there are many different kinds of telephones – rotary dial, touch-tone, wall, desk, cordless, speaker, cellular, pay phone. How many kinds can you find with your child? Look at the phones in the homes of your family and friends. Plan a visit to a phone mart or department store where the latest models are on display.

Does your own phone have any special features? If so, help your child learn how to use them.

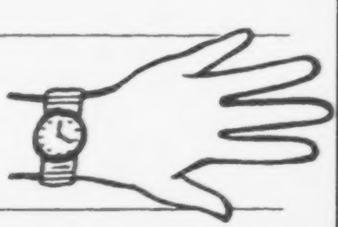
Review important telephone numbers with your child. Does your child know how and when to call 911? Who to call in an emergency if you are not available? How to make a long distance call and a collect call? How to use a pay phone? **(Energy and Communication)**



TIME AWARENESS

It is important for children to be aware of time. You can help your child become used to thinking about time by tying it to daily activities. You might say such things as: "It's 7:00 – time to get up." "It's 7:30 – time for breakfast." "It's 8:15 – time to go to school." Connect such common words as *time for school, dinnertime, time for a bedtime story* with "clock time." **(Time, Weather and Sky)**

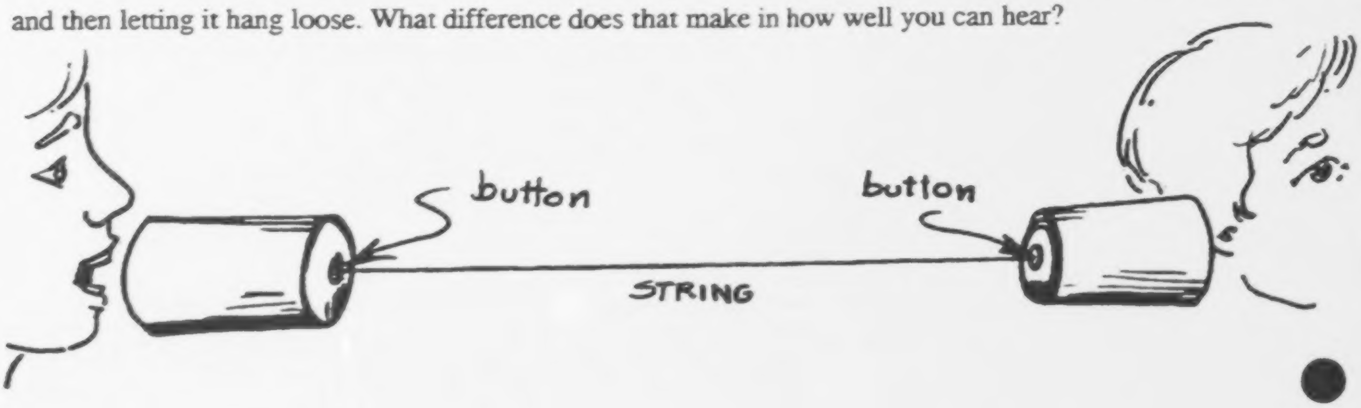
Suggestion: A digital clock or watch is a good gift for a child in the third grade. Either is easy to read and will help your child learn to tell time. Later, when your child is comfortable with telling time, a two-handed analog watch or clock would make an excellent gift.



VOLUME 3, NUMBER 2

MAKE A STRING TELEPHONE

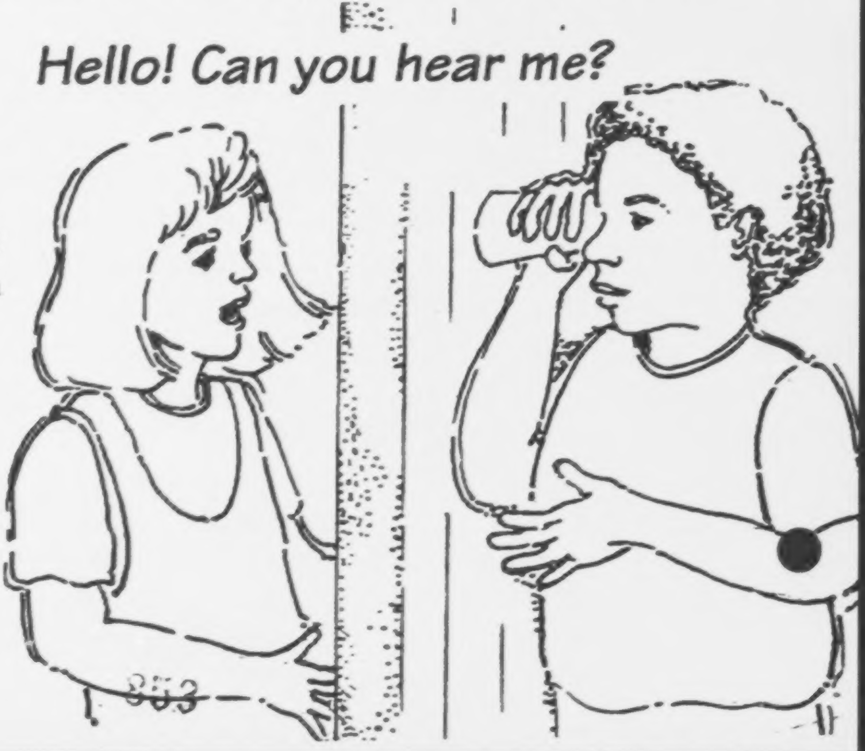
Help your child make a string telephone and explore a nonelectrical way to carry sound through a line. Investigate such things as changing the tension on the line, going around corners, wetting the string, and using different kinds of cups and cans. Experiment to see how long a string you can use. Try pulling the string tight and then letting it hang loose. What difference does that make in how well you can hear?



AMPLIFYING SOUND

Experiment with other ways of amplifying sound. Have your child hold the mouth of a glass against a wall and put his or her ear to the bottom of the glass. Then have someone talk in the next room with the door closed. Can your child hear through the wall with the glass? Have your child talk in the next room while you listen with the glass. Can you hear your child?

Roll a piece of paper into a cone. Put the wide end next to your child's heart and put your ear to the narrow end. Listen for a heartbeat. Have your child listen to your heartbeat this way. **(Matter, Space and Construction; Energy and Communication)**


Hello! Can you hear me?